



M306N0T2-RPD-E User's Manual

**Emulation Pod
for
M16C/6N Group M306N0 and M306N1**

First Edition: December 1, 2000

**Mitsubishi Electric Corporation
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Note: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

Warning: This is a Class A product. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.

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Preface

The M306N0T2-RPD-E is an emulation pod for the M16C/6N Group M306N0 and M306N1 of Mitsubishi 16-bit MCUs. It's used with a PC4701 emulator.

This user's manual mainly describes specifications of the M306N0T2-RPD-E emulation pod and how to setup it. For details on the following products, which are used with M306N0T2-RPD-E, refer to each product's user's manual.

- Emulator: PC4701 User's Manual
- Emulator debugger: PD30 User's Manual

All the components of this product are shown in "Table 2.1 Package components" (page 23) of this user's manual. If there is any question or doubt about this product, contact your nearest Mitsubishi office or distributor.

To use the product properly

Precautions for Safety



- In both this User's Manual and on the product itself, several icons are used to insure proper handling of this product and also to prevent injuries to you or other persons, or damage to your properties.
- The icons' graphic images and meanings are given in "Chapter 1. Precautions for Safety" (page 7). Be sure to read this chapter before using the product.

When using outside Japan



- When using in Europe, the United States, or Canada, be sure to use both the emulator and the emulation pod which meet local standards. EMI standards are not met when the M306N0T2-RPD-E is used with the PC4700H or PC4700L emulator.

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M306N0T2-RPD-E Repair Request Sheet

Technical Support Communication Sheet

MEMO

Chapter 1. Precautions for Safety

This chapter describes precautions for using this product safely and properly. For precautions for the emulator main unit and the emulator debugger, refer to each user's manual included with your product.

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Chapter 1. Precautions for Safety

In both the User's Manual and on the product itself, several icons are used to insure proper handling of this product and also to prevent injuries to you or other persons, or damage to your properties.

This chapter describes the precautions which should be taken in order to use this product safely and properly. Be sure to read this chapter before using this product.

1.1 Safety Symbols and Meanings



WARNING

If the requirements shown in the "WARNING" sentences are ignored, the equipment may cause serious personal injury or death.



CAUTION

If the requirements shown in the "CAUTION" sentences are ignored, the equipment may cause personal injury or damage to the products.

IMPORTANT

NOTE: Important information on using this product.

In addition to the three above, the following are also used as appropriate.



means WARNING or CAUTION

Example:



CAUTION AGAINST AN ELECTRIC SHOCK



means PROHIBITION

Example:



DISASSEMBLY PROHIBITED



means A FORCIBLE ACTION

Example:



UNPLUG THE POWER CABLE FROM THE RECEPTACLE.

The following pages describe the symbols "WARNING", "CAUTION" and "IMPORTANT".

WARNING

Warning for Installation:



- Do not set this product in water or areas of high humidity. Spilling water or some other liquid into the main unit can cause an unrepairable damage.

Warnings for Use Environment:



- The emulation pod is air-cooled with the ventilation slot. Therefore, do not block the ventilation slot. When heated to high temperatures, the emulation pod may not work properly.
- This equipment is to be used in an environment with a maximum ambient temperature of 35°C. Care should be taken that this temperature is not exceeded.

CAUTION

Caution to Be Taken for Modifying This Product:



- Do not disassemble or modify this product. Disassembling or modifying this product can cause damage. Disassembling and modifying the product will void your warranty.

Cautions to Be Taken for Handling This Product:



- Use caution when handling the main unit. Be careful not to apply a mechanical shock.
- Do not touch the connector pins of the emulator main unit and the target MCU connector pins. Static electricity may damage the internal circuits.
- Do not pull the emulation pod main unit by the flexible cable (FLX120-RPD) for connecting to the emulator main unit or the flexible cable (FLX64, FLX100 or FLX160) for connecting the target system. The cable may cause a break.
- Flexible cable (FLX120-RPD) for connecting to the emulator main unit and the flexible cable (FLX64, FLX100 or FLX160) for connecting the target system are different from earlier models. The slits make them more flexible. However, excessive flexing or force may break conductors.
- Do not use inch-size screws for this equipment. The screws used in this equipment are all ISO (meter-size) type screws. When replacing screws, use same type screws as equipped before.

IMPORTANT

Note on Malfunctions in the PC4701 System:

- If the emulator malfunctions because of interference like external noise, do the following to remedy the trouble.
 - (1) Press the RESET switch on the emulator front panel.
 - (2) If normal operation is not restored after step (1), shut OFF power to the emulator once and then reactivate it.

IMPORTANT

Notes on Downloading Firmware:

- Before using this product for the first time, it is necessary to download the dedicated firmware (control software for the emulation pod built into the PC4701). Please note that, to do this, it is necessary to start up the PC4701 in the maintenance mode. For firmware download procedures, see "4.2 Downloading Firmware" (page 50). Once the firmware has been downloaded, the product can be used by simply turning on the power.
- Do not shut off the power while downloading the firmware. If this happens, the product will not start up properly. If power is shut off unexpectedly, redownload the firmware.
- Except when a target status error occurs, if self-checks are not completed successfully, there may be trouble with the product. In such case, contact your sales representative. However, perform self-checks in the below setup.

- | | |
|--------------------------------------|---------------------------|
| (1) Target system: | Not connected |
| (2) Emulation pod internal switches: | At their factory settings |

Note on When the Emulator Debugger Ends:

- To restart the emulator debugger after it ends, always shut power to the emulator module off once and then on again.

Note on Final Evaluation:

- Be sure to evaluate your system with an actual MCU. Before starting mask production, evaluate your system and make final confirmation with a CS (Commercial Sample) version MCU.

Notes on Target System:

- The Vcc pin of emulator is connected to the target system to observe the voltage of the target system. Therefore design your system so that the emulator MCU is powered by the target system.
- The voltage of the target system should be within the range of the MCU specification (4.2 - 5.5 V).
- Do not change the voltage of the target system after turning on the power.
- Before powering on your emulator system, check that the host machine, the emulator main unit, the converter board and target system are all connected correctly. Next, turn on the power to each equipment following the procedure below.
 - (1) Turn ON/OFF the target system and the PC4701 emulator as simultaneously as possible.
 - (2) When the PC4701 and emulator debugger start up, check the target status LEDs on the emulator main unit's front panel to see if this product is ready to operate.
 - Is the power supplied? Check target status LED (POWER) is ON.

For details, refer to "Chapter 4. Usage" (page 47).

Notes on Stack Area:

- With this product, a maximum 8 bytes of the user stack is consumed.
- If the user stack does not have enough area, do not use areas which cannot be used as stack (SFR area, RAM area which stores data, or ROM area) as work area. Using areas like this is a cause of user program crashes and destabilized emulator control. Therefore, ensure the +8 bytes maximum capacity used by the user program as the user stack area.

IMPORTANT

Notes on MAP References and Settings:

- For details on referencing and setting MAP information, see User's Manual of emulator debugger PD30.

- Be sure to set the SFR area to EXTERNAL (an external section).

- When setting 0FFFCh - 0FFFFh to EXTERNAL:

This product uses the 4 bytes area 0FFFCh - 0FFFFh as the stack area. If this 4 bytes memory cannot be read or written to, reset cannot be properly effected. As a result, you need to alter the map settings if the condition given below is met.

- (1) With the system which shifts from the single-chip mode to the memory expansion (or microprocessor) mode, using the 4 bytes area of 0FFFCh - 0FFFFh set to EXTERNAL.
- (2) With the system which starts up in the microprocessor mode, using the 4 bytes area of 0FFFCh - 0FFFFh set to EXTERNAL and there is not enough memory to read or write.

The procedures to alter the MAP settings when the conditions (1) or (2) above are met are shown below.

- (1) Set the 4 bytes area of 0FFFCh - 0FFFFh to INTERNAL.
- (2) Execute the RESET command of emulator debugger PD30.
- (3) Set the stack pointer.

(Example)

RESET:

```
FCLR    I
LDC     #0480H, SP  <-- Set the stack pointer.
                               (Stop the program after executing this instruction.)
.
```

- (4) Set the 4 bytes area 0FFFCh - 0FFFFh to EXTERNAL.

Note on Setting the Work Area:

- To use this product, it is necessary to set the work area in the internal reserved area of the MCU. However, do not set it in the last 10 bytes of the internal reserved area. And be sure to set the internal reserved area to INTERNAL. (Set the work area by Init dialog of emulator debugger PD30.)

Example 1: When debugging the program of the MCU whose internal reserved area is 02C00h - 03FFFh, set the work area within the range of 02C00h - 03FF6h.

Example 2: When debugging the program of the MCU whose internal reserved area is 05400h - 05FFFh, set the work area within the range of 05400h - 05FF6h.

For instance, when setting the work area at 05C00h, the emulator uses 10 bytes area of 05C00h - 05C09h.

IMPORTANT

Note on RESET* Input:

- The RESET* input from the target system is accepted only while a user program is being executed (only while the RUN status LED on the PC4701's front panel is lit).

Note on HOLD* Input:

- Be sure to input "L" to the HOLD* pin of the target system during the user program executing (while the RUN status LED on the PC4701's front panel is lit). Inputting "L" to the HOLD* pin when stopping the user program may cause a malfunction of the emulator.

Note on RDY* Input:

- Be sure to input "L" to the RDY* pin of the target system during the user program executing (while the RUN status LED on the PC4701's front panel is lit). Inputting "L" to the RDY* pin when stopping the user program may cause a malfunction of the emulator.

Notes on NMI* Input:

- NMI* input from the target system is accepted only while a user program is being executed (only while the RUN status LED on the PC4701's front panel is lit).
- The NMI* interrupt is generated in the following situations.
 - (1) Immediately after the NMI* pin changes from "H" to "L" level during target program execution
 - (2) After the reset is released by the target system when the NMI* pin is "L" level during target program execution
 - (3) Immediately after program execution starts with the NMI* pin "L" level, following the reset input from the debug software or emulator main unit
 - (4) Immediately after program execution starts when the NMI* pin is "H" level immediately before the target program stops and changes to "L" level when target program execution starts

Note on Clock Supply to the MCU:

- Clock can be supplied to the evaluation MCU in one of the following two ways. This is determined by emulator debugger clock selection.
 - (1) When Internal is selected:

The clock generated by the oscillation circuit in the emulation pod is supplied to the evaluation MCU. The clock is continually supplied to the evaluation MCU regardless of "target system clock status" and "user program execution status".
 - (2) When External is selected:

Clock supply to the evaluation MCU depends on oscillation status (oscillate/off) of the target system.

IMPORTANT

Notes on Interruption:

- Even when the target program is not being executed (while the target program is stopped or during runtime debugging), the evaluation MCU keeps running so as to control the emulation pod. Therefore, note that timers and other components do not stop running even though the target program is not being executed.
- If a maskable interrupt request is generated when the target program is not being executed (while the target program is stopped or during runtime debugging), the request is not accepted because the emulator disables all interrupts. If an interrupt request is generated when the target program is not being executed, but the target program enables that interrupt, it will be accepted immediately after program execution starts.

Note on Address 00000h Access:

- With the M16C/6N Group MCUs, when a maskable interrupt is generated, the interrupt data (interrupt No. and interrupt request level) stored in address 00000h is read out. Also, the interrupt request bit is cleared when address 00000h is read out. Consequently, when the address 00000h readout instruction is executed or when address 00000h is read out in the cause of a program runaway, a malfunction occurs in that the interrupt is not executed despite the interrupt request, because the request bit of the highest priority interrupt factor enabled is cleared.

For this malfunction, when the reading out to the address 00000h is generated excluding the interrupt, the yellow LED lights up to alarm. When this LED lights, there is a possibility of wrong access to address 00000h, therefore check the program. This LED is turned off by the RESET switch of the emulator main unit.

Note on Stop and Wait Modes:

- Do not perform step execution at addresses in the stop or wait mode. It may cause communication errors.

Note on Software Reset:

- Do not use a software reset.

Note on BRK Instruction and BRK Instruction Interruption:

- With this emulator system, BRK instructions and BRK instruction interruptions are exclusively used for S/W break functions. Therefore, you can not use them for your program.

Notes on Address Match Interrupt:

- Do not set software breaks at the same addresses as address-match interrupts as the program may run out of control.
- Do not set a hardware break within 4 instructions before an address at which an address-match interrupt occurs. If you do set a hardware break in this range, the program will run out of control.
- When an address at which an address-match interrupt occurs is executed in one-step mode, the program stops after executing the first instruction after returning from the address-match interrupt processing.

IMPORTANT

Note on Commands that Access the Single-step Interrupt Vector Area:

- Do not perform the below debugging operations with the single step interrupt vector area (addresses FFFECh - FFEFh).
 - (1) Step execution of commands that access the single step interrupt vector area
 - (2) Program execution using commands that access the single step interrupt vector area when a software breakpoint is set in those commands

Note on DMA Transfer:

- With this product, the program is stopped with a loop program to a specific address. Therefore, if a DMA request is generated by a timer or other source while the program is stopped, DMA transfer is executed. However, make note of the fact that DMA transfer while the program is stopped may not be performed correctly. Also note that the below registers have been changed to generate DMA transfer as explained here even when the program is stopped.

DMA0 transfer counter register: TCR0

DMA1 transfer counter register: TCR1

Notes on S/W Breaks and H/W Breaks:

- S/W breaks generate BRK interrupts by substituting the proper instruction to the BRK instruction. Therefore, when referencing the result of a trace in bus mode, "00h" is displayed for the instruction fetch address where a software break is set, and when referencing in reverse assemble mode, "BRK" instruction is displayed.
- It is not possible to use a S/W break and a H/W break at the same time. If doing so, it may not operate normally.
- In the area where the MAP setting is EXTERNAL, S/W breaks cannot be used.

Note on Protect Resistor (PRC2):

- Make note of the fact that the protect is not canceled when protect register (PRC2), which enables writing in the port P7 and port P9 direction registers and the SI/O3, 4 control registers, is changed with the below procedure.
 - (1) Step execution of the "instruction for setting ("1") PRC2"
 - (2) Setting the break point from the "instruction for setting ("1") PRC2" to when the "setting the register for the protect"
 - (3) Setting ("1") PRC2" from the dump window or script window

IMPORTANT

Note on Pullup Control Resistor:

- Ports P00 to P57 are not pulled up by the pullup control resistor.

When pulling up the ports P00 to P57, apply a resistance to the inside of the emulator. How to apply it, refer to "3.2 Setting Switches and Pullup Resistors" (page 29).

Note: Ports P60 to P107 are pulled up by the pullup control resistor.

Note: The pullup control resistor can read and write from P00 to P107 properly.

- When the pullup control resistor 1 (bit 1 of address 3FDh = PU11) of Ports P44 - P47 is set to "1" (pulled up), ports P15 - P17 are pulled up regardless of the value of the pullup control resistor 0 (bit 3 of address 3FCh = PU03) of Ports P14 - P17.

Note on Reading Internal Resources of an MCU:

- When the registers that are listed in Table 1.1 are read with an emulator, those results will be the following (the data in the MCU are not effected).

(1) Results of real-time trace

The data values of the cycles read are not displayed correctly.

(2) Real-time RAM monitor

The data values read are not displayed correctly.

Table 1.1 Registers and symbols not displayed normally

Register Symbol	
DMA source pointers 0, 1	SAR0, SAR1
DMA destination pointers 0, 1	DAR0, DAR1
DMA transfer counters 0, 1	TCR0, TCR1
DMA control resistors 0, 1	DM0CON, DM1CON

Notes on Watchdog Function:

- The MCU's watchdog timer can be used only while programs are being executed. To use it otherwise, disable the watchdog timer.
- If the reset circuit of the target system has a watchdog timer, disable it when using the emulator.

IMPORTANT

Note on Differences between Actual MCU and Emulator:

- Operations of the emulator system differ from those of actual MCUs as listed below.
 - (1) Reset condition
Set the rise time (0.2 Vcc to 0.8 Vcc) 1 μ s or less.
 - (2) Data values of ROM and RAM areas at power-on
 - (3) Internal memories (ROM and RAM) capacities etc.
With this emulator system, "INT" (emulation memory ON) is the default for mapping areas other than the SFR area (addresses 000h - 3FFh). For this reason, the emulation memory can read and write in areas other than the SFR, internal RAM and internal ROM.
 - (4) Oscillator circuit
 - Make note of the fact that in the oscillator circuit where a resonator is connected between the X_{IN} and X_{OUT} pins, oscillation does not occur because a flexible cable, buffer IC and other devices are used between the evaluation MCU and the target system. It is same for sub-clock oscillator circuits (X_{CIN} and X_{COUT}).
 - For note on when using the oscillator circuit on the target system, refer to "3.3 (1) Using the Oscillator Circuit on the Target System" (page 34).
 - (5) Characteristics of ports P00 to P57
With this product, ports P00 to P57 are connected via emulation circuit. The device used for the port emulation circuit is as follows.

Device: M60081L-0142FP
 - (6) Characteristics of port P10
With this product, parts of I/O ports (P10) is connected to the target system via analog switch circuit. Therefore the electrical characteristics are slightly different from those of actual MCUs.
 - (7) HOLD* control
When inputting "L" to the HOLD* pin to run into the HOLD state, P00 to P52 will be in the HOLD state delaying by 2.5 cycles than the actual MCU (see Figure 5.5 and Table 5.5).
 - (8) DBC, Single-step and BRK instruction interrupt vector table addresses
As the emulator uses the DBC, Single-step and BRK instruction interrupt vector table addresses, when reading these addresses, the downloaded data cannot be read (see Table 1.2).

Table 1.2 Vector table addresses for the emulator

Factor of interruption	Vector table addresses	Data for reading
DBC* ¹	FFFF4h - FFFF7h	Indefinite
Single-step* ¹	FFFECh - FFEEFh	Indefinite
BRK instruction	FFFE4h - FFEE7h	Indefinite

*1 Interruption for the debugger only

- (9) A-D conversion
As a analog switch, flexible cable, pitch converter board and other devices are used between the evaluation MCU and the target system, some characteristics are slightly different from those of the actual MCU.
- (10) D-A conversion
As a flexible cable, pitch converter board and other devices are used between the evaluation MCU and the target system, some characteristics are slightly different from those of the actual MCU.
- (11) Oscillation stop detection function
With this product, you can not debug the oscillation stop detection function.

IMPORTANT

(12) A-D input group select function

When using the A-D input group select function, the following settings are required.

i) When selecting port P0 for A-D input

- Set the whole 8-bit of direction registers P107 - P100 to input.
- Set the pullup control resistors of P107 - P100 to no-pullup.
- P107 - P100 cannot be used as an input pin of I/O port and key input interrupt function.

ii) When selecting port P2 for A-D input

- Set the whole 8-bit of direction registers P107 - P100 to input.
- Set the pullup control resistors of P107 - P100 to no-pullup.
- P107 - P100 cannot be used as an input pin of I/O port and key input interrupt function.

iii) When selecting port P10 for A-D input

- There is no restriction.

(13) Outputs of the actual MCU and this product

Table 1.3 Differences of outputs between actual MCU and this product (when executing program)

Access area	Signal	Actual MCU	This product	* for difference
SFR area (MAP = EXT)	Address BHE*	Outputs	Outputs	
	Data	Outputs (floating during read operating)	Floating	*
	RD* WR*	Outputs ("L" at write cycle, "L" at read cycle)	Does not output (fixed to "H" output)	*
	CS*	Does not output (fixed to "H" output)	Does not output (fixed to "H" output)	
	ALE	Does not output (fixed to "L" output)	Outputs	*
Internal RAM Internal ROM	Address BHE*	Retains previous status	Outputs	*
	Data	Floating	Floating	
	RD* WR*	Does not output (fixed to "H" output)	Does not output (fixed to "H" output)	
	CS*	Does not output (fixed to "H" output)	Does not output (fixed to "H" output)	
	ALE	Does not output (fixed to "L" output)	Outputs	*
External area	Address BHE*	Outputs	Outputs	
	Data	Outputs (inputs external data at read cycle)	Outputs (inputs external data at read cycle)	
	RD* WR*	Outputs ("L" at write cycle, "L" at read cycle)	Outputs ("L" at write cycle, "L" at read cycle)	
	CS*	Outputs	Outputs	
	ALE	Outputs	Outputs	

IMPORTANT

Table 1.4 Differences of outputs between actual MCU and this product (in stop mode)

Access area	Signal	Actual MCU	This product	* for difference
-	Address BHE*	Retains previous status	Retains previous status	
	Data	Retains previous status	Floating	*
	RD* WR*	Does not output (fixed to "H" output)	Does not output (fixed to "H" output)	
	CS*	Retains previous status	Retains previous status	
	ALE	Does not output (fixed to "H" output)	Does not output (fixed to "H" output)	

Table 1.5 Differences of outputs between actual MCU and this product (in wait mode)

Access area	Signal	Actual MCU	This product	* for difference
-	Address BHE*	Retains previous status	Retains previous status	
	Data	Retains previous status	Floating	*
	RD* WR*	Does not output (fixed to "H" output)	Does not output (fixed to "H" output)	
	CS*	Retains previous status	Retains previous status	
	ALE	Does not output (fixed to "H" output)	Does not output (fixed to "H" output)	

Table 1.6 Outputs of this product when the user program is stopping

Signal	This product
Address BHE*	Outputs
Data	Floating
RD* WR*	Only RD* outputs (WR* is fixed to "H" output)
CS*	Outputs
ALE	Outputs

MEMO

Chapter 2. Preparation

This chapter describes the package components, the system configuration and the preparation for using this product for the first time.

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2.2 Package Components.....	23
2.3 Other Tool Products Required for Development.....	23
2.4 Name of Each Part	24
(1) System Configuration	24
(2) Inside of Emulation Pod	25
2.5 When Using the Emulator for the First Time	26

Chapter 2. Preparation

2.1 Terminology

Some specific words used in this user's manual are defined as follows:

Emulator system

This means an emulator system built around the PC4701 emulator. The PC4701 emulator system is configured with an emulator main unit, emulation pod, host machine and emulator debugger.

Emulator main unit (Hereafter PC4701)

This means a generic name for emulators for 8 and 16-bit MCUs. For details on specific models of PC4701, visit Mitsubishi Tool Homepage.

Homepage URL http://www.tool-spt.mesc.co.jp/index_e.htm

Emulation pod

This means M306N0T2-RPD-E (this product). This emulation pod is for M16C/6N Group M306N0 and M306N1.

Host machine

This means a personal computer used to control the emulator and emulation pod.

Emulator debugger

This means a software tool PD30 to control the emulator from the host machine through an interface.

Firmware

Program that analyzes contents of communication with the emulator debugger and controls the emulator hardware. This program is installed in the EEPROM. This program is downloadable from the emulator debugger to upgrade the firmware or to support other MCUs.

Software break

A software break is a function to break the program before the system executes an instruction at the specified address. The instruction at the preset address will not be executed.

Hardware break

A hardware break is a function to break the program when the system detects a write/read of data to/from memory or a rise/fall edge of the signal entered from the external trace cable. The former break function is called address break; and the latter break function is called trigger break. While the instruction at the address where the software break is set is not executed, a hardware break is performed after the specified instruction is executed.

Evaluation MCU

This means the microcomputer mounted on the emulation pod which is operated in the specific mode for tools.

Target MCU

This means the microcomputer you are going to debug.

Target system

This means a user's application system using the microcomputer to be debugged.

*

In this user's manual, this symbol is used to show active LOW. (e.g. RESET*: Reset signal)

2.2 Package Components

The M306N0T2-RPD-E package consists of the following items. When unpacking, check to see if your M306N0T2-RPD-E contains all of these items.

Table 2.1 Package components

Item	Quantity
M306N0T2-RPD-E emulation pod main unit	1
FLX120-RPD flexible cable for connecting PC4701	1
FLX100 flexible cable for connecting converter board (pre-installed in emulation pod)	1
FLX-100LCC converter board for connecting target system	1
OSC-3 (16 MHz) oscillator circuit board (pre-installed in emulation pod)	1
OSC-2 oscillator circuit board	1
Resistor arrays for pulling up ports P00 to P57 (51 kΩ)	12
Hardware tool user registration FAX sheet (English)	1
Hardware tool user registration FAX sheet (Japanese)	1
M306N0T2-RPD-E user's manual (this manual)	1
M306N0T2-RPD-E user's manual (Japanese)	1

Please keep the M306N0T2-RPD-E's packing box and cushion material in your place for reuse at a later time when sending your product for repair or other purposes. Always use these packing box and cushion material when transporting this product.

If any of these items are missing or found faulty, please contact your distributor. Also, if there is any question or doubt about the packaged product, contact your distributor.

2.3 Other Tool Products Required for Development

To bring forward programs development on the M16C/6N Group MCUs, the products listed below are necessary in addition to those contained package above. Get them separately.

Table 2.2 Other tool products

Product		Product name	Notes
Emulator main unit		PC4701	Required
Emulator debugger		PD30	Required
Converter boards	100-pin 0.65-mm-pitch QFP (100P6S-A)	DUMMY100S	Required according to the foot pattern of the target system (see 3.6 "Connecting the Target System" on page 40)
		DIRECT100S	
		FLX-100NRB	
	100-pin LCC socket	IC61-1004-051 etc.	

* To purchase these products, contact your nearest distributor.

* For details on the IC61-1004-051, contact Yamaichi Electronics Co., Ltd.

2.4 Name of Each Part

(1) System Configuration

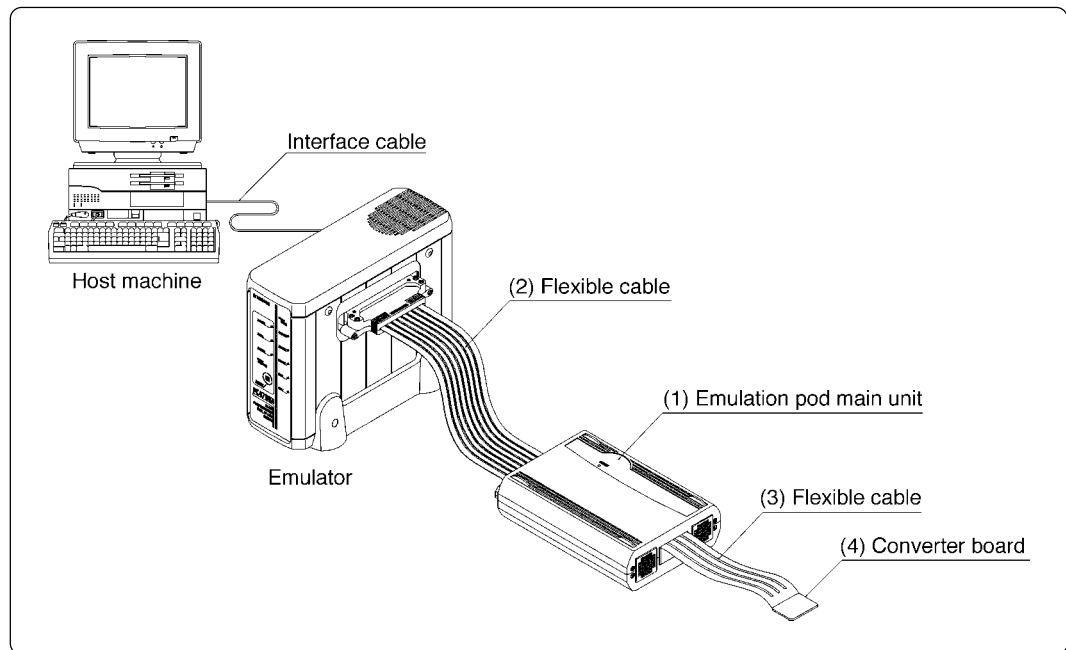


Figure 2.1 System configuration

(1) to (4) in Figure 2.1 are included in this product package.

(1) Emulation pod (M306N0T2-RPD-E)

This emulation pod contains an evaluation MCU, emulation memory and circuits to feature the debugging function.

(2) Flexible cable (FLX120-RPD)

This is a 120-pin flexible cable for connecting the PC4701 emulator and the emulation pod.

(3) Flexible cable (FLX100)

This is a 100-pin flexible cable for connecting the emulation pod and the target system.

(4) Converter board

This is a converter board for connecting to the target system. For details, refer to "3.6 Connecting the Target System" (page 40).

(2) Inside of Emulation Pod

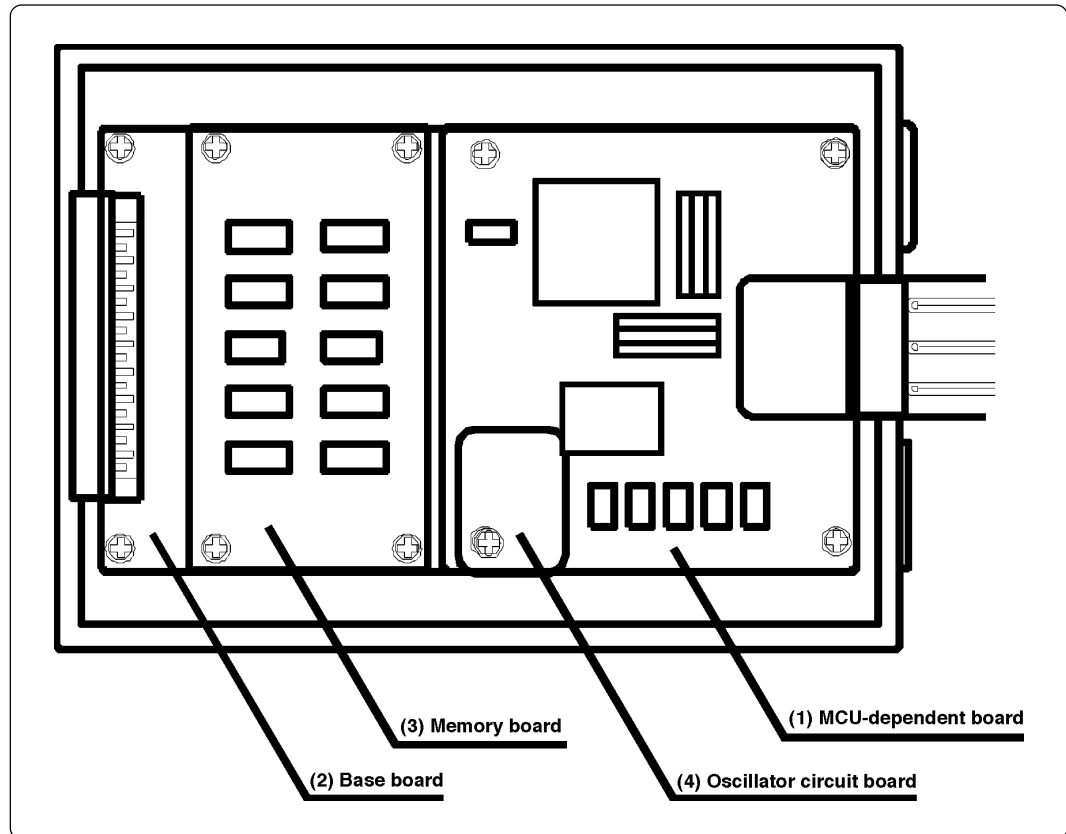


Figure 2.2 Internal view of emulation pod

(1) MCU-dependent board

Board grouping parts (pins and added functions) which vary according to MCU model.

(2) Base board

Board for the M16C/60 Series MCUs which controls the interface with the PC4701 and the evaluation MCU.

(3) Memory board

Board for the M16C/60 Series MCUs on which the emulation memory (1 MB) and the map memory (4 bit \times 1 M) are mounted.

(4) Oscillator circuit board

Oscillator circuit board on which the oscillation module device (16 MHz) is mounted. It is possible to change the operating frequency by replacing it with a separately prepared oscillator circuit board.

2.5 When Using the Emulator for the First Time

If you have purchased this emulation pod newly, it is necessary to download the firmware. The download procedure is given in Figure 2.3.

Before attempting to download the firmware, check the emulator debugger is installed and the emulator is connected to the host machine. For more information, see each user's manual of the emulator debugger and the PC4701.

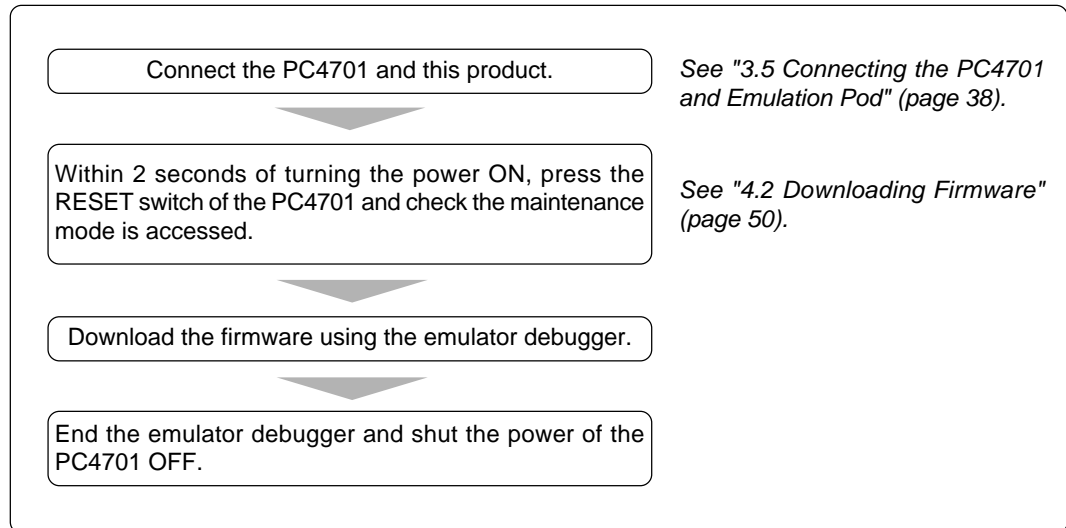


Figure 2.3 Firmware download procedure when emulator is used for the first time

To make sure the emulation pod works properly, run the self-checks. For self-check procedures, see "4.3 Self-checks" (page 51).

Chapter 3. Setting Up

This chapter describes switch settings required for using this product and how to connect this product to the PC4701 and the target system.

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Chapter 3. Setting Up

To use this emulation pod with your target system, it is necessary to set as follows. Set the following after removing the upper cover.

- Change the oscillation frequency in the emulation pod.
- Set the switches according to the target system.
- Install a pullup resistors to ports P00 to P57.
- Install the A-D conversion bypass capacitor.

3.1 Removing the Upper Cover

The procedure of removing the upper cover is shown below.

- (1) Remove the four screws of both sides of this product and lift off the upper cover. (see Figure 3.1)
- (2) Set the jumper switches and others as described below.
- (3) Replace the upper cover and secure the four screws.

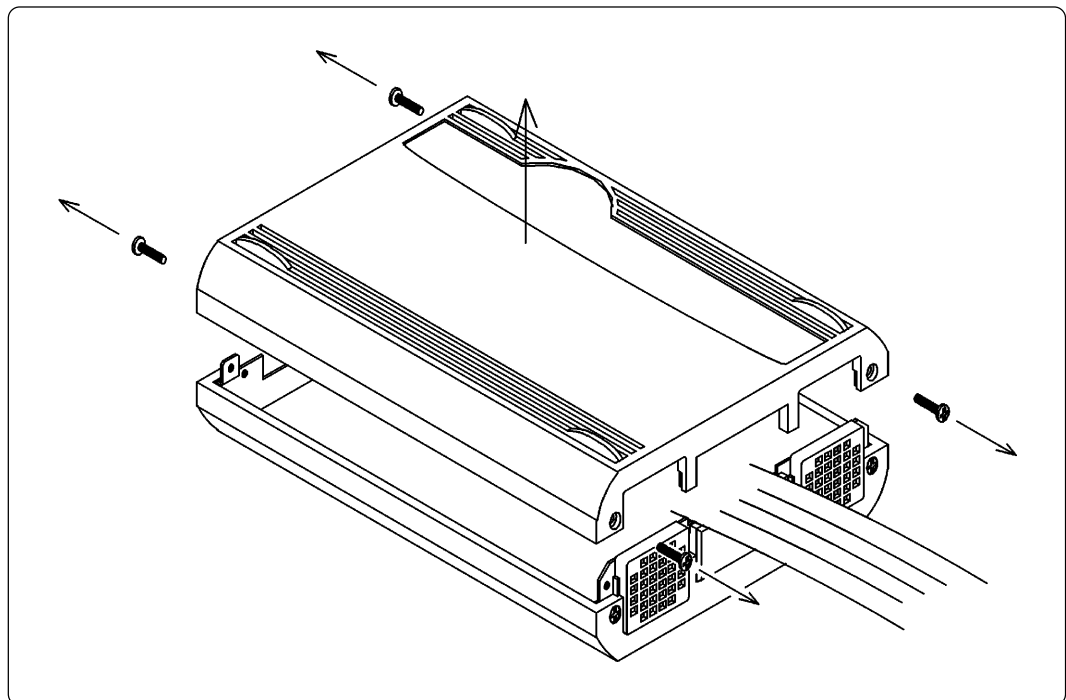


Figure 3.1 Removing the upper cover

CAUTION

When Removing the Upper Cover:

- Always shut OFF power when removing the upper cover or setting the switches.
- Do not touch the connector pins of the emulator main unit and the target MCU connector pins. Static electricity may damage the internal circuits.

3.2 Setting Switches and Pullup Resistors

Figure 3.2 shows the positions of switches and a position for installing pullup resistors. Tables 3.1, 3.2 list how to set each switch and Figure 3.3 shows how to install pullup resistors.

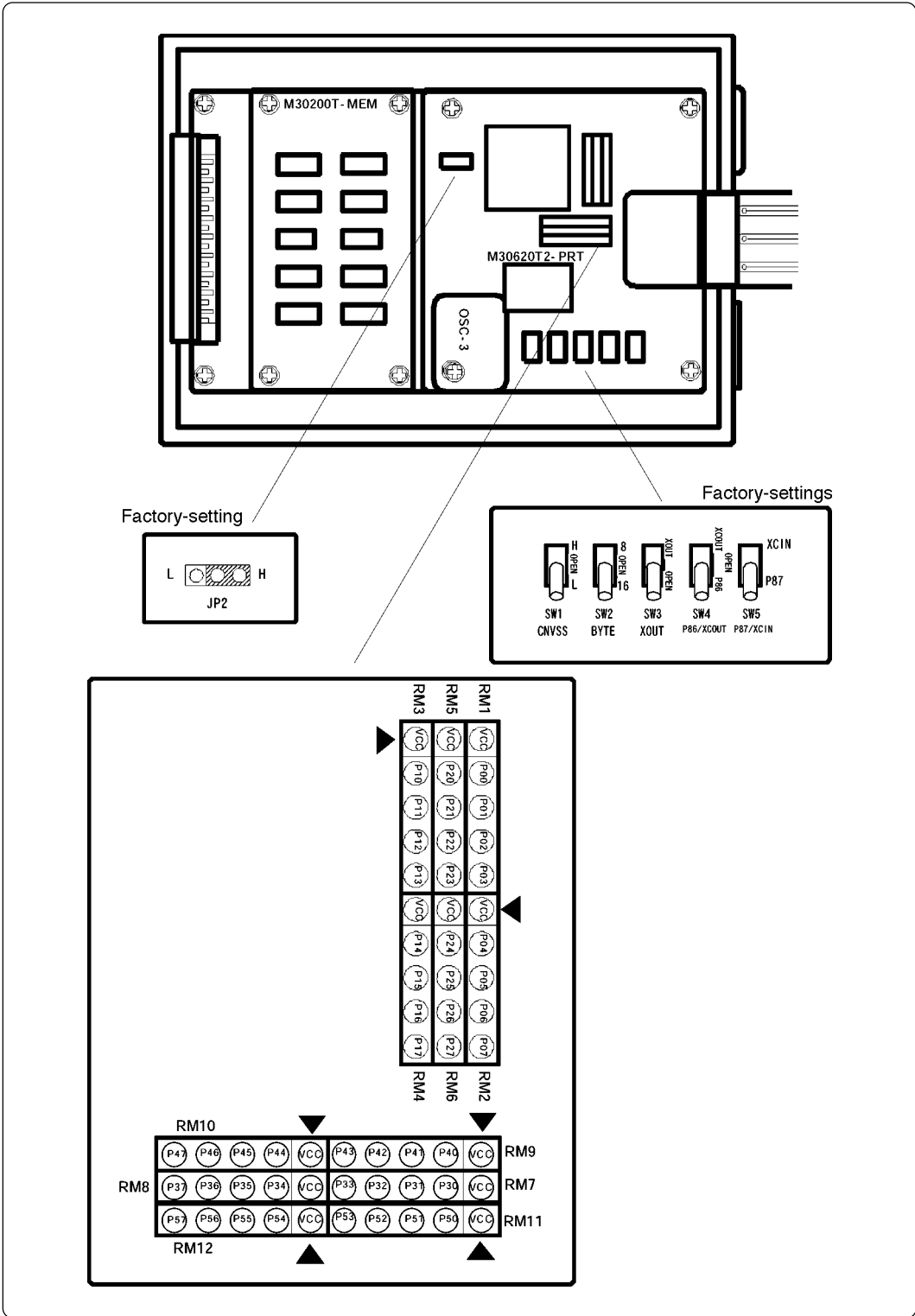


Figure 3.2 Positions of switches and their factory-settings

Table 3.1 Switch settings of the M306N0T2-RPD-E (1/2)















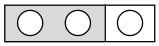
Signal	Switch	Setting	Description
CNV _{ss}	SW1	 H OPEN L SW1 CNV _{ss} (Factory-setting)	Pulls down the CNV _{ss} pin of MCU with a resistance of 33 kΩ.
		 H OPEN L SW1 CNV _{ss}	Does not pull down/up the CNV _{ss} pin of MCU.
		 H OPEN L SW1 CNV _{ss}	Pulls up the CNV _{ss} pin of MCU with a resistance of 33 kΩ.
BYTE	SW2	 8 OPEN 16 SW2 BYTE (Factory-setting)	Pulls down the BYTE pin of MCU with a resistance of 33 kΩ.
		 8 OPEN 16 SW2 BYTE	Does not pull down/up the BYTE pin of MCU.
		 8 OPEN 16 SW2 BYTE	Pulls up the BYTE pin of MCU with a resistance of 33 kΩ.
X _{OUT}	SW3	 XOUT OPEN SW3 XOUT (Factory-setting)	Does not connect the X _{OUT} pin of MCU to the target system.
		 XOUT OPEN SW3 XOUT	Connects the X _{OUT} pin of MCU to the target system.

Table 3.2 Switch settings of the M306N0T2-RPD-E (2/2)

Signal	Switch	Setting	Description
P86/X _{COUT}	SW4	 SW4 P86/X _{COUT} (Factory-setting)	Connects the P86/X _{COUT} pin of MCU to the target system. (Uses P86/X _{COUT} pin as port P86)
		 SW4 P86/X _{COUT}	Does not connect the P86/X _{COUT} pin of MCU. (Uses P86/X _{COUT} pin as X _{COUT} and opens X _{COUT} .)
		 SW4 P86/X _{COUT}	Connects the P86/X _{COUT} pin of MCU to the target system. (Uses P86/X _{COUT} pin as X _{COUT} and connect X _{COUT} to the target system.)
P87/X _{CIN}	SW5	 SW5 P87/X _{CIN} (Factory-setting)	Connects the P87/X _{CIN} pin of MCU to the target system. (Uses P87/X _{CIN} pin as port P87)
		 SW5 P87/X _{CIN}	Uses P87/X _{CIN} pin as X _{CIN} .
	JP2	 JP2 (Factory-setting)	Only this setting is available.
		 JP2	Does not set in this way.

IMPORTANT

Note on Switch Settings:

- Switches SW1 (CNV_{SS}) and SW2 (BYTE) are used for debugging operation without connecting the target system. When connecting the target system, set both of them "OPEN".

It is not possible to control the pullup by the pullup control resistors of ports P00 to P57 (possible to read and write by the pullup control resistors).

However, as this product has sockets for installing the pullup resistors, it is possible to pull up by mounting the resistor arrays included with this product. For the positions for installing the pullup resistors, see Figure 3.3.

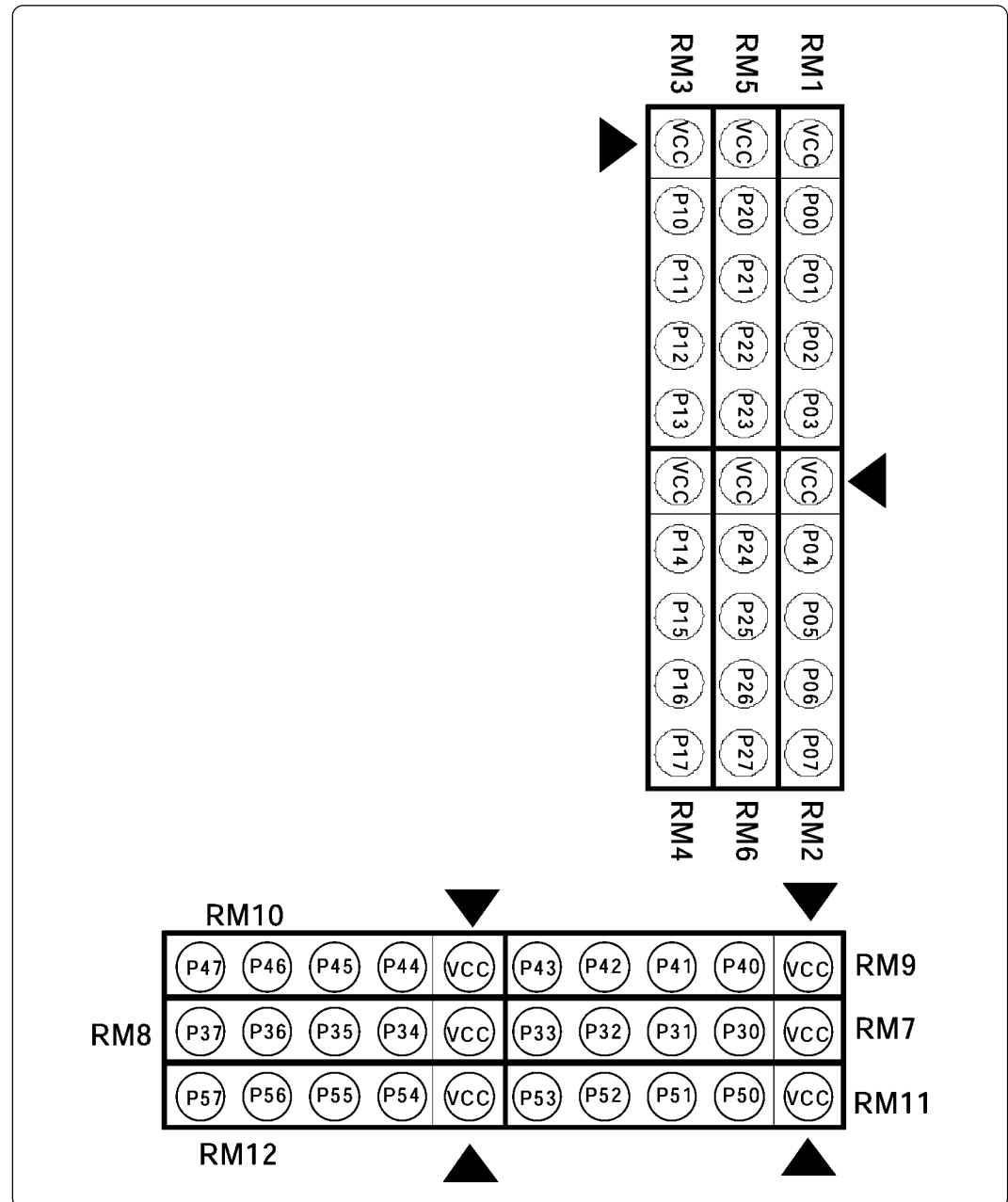


Figure 3.3 Positions for installing the pullup resistors

3.3 Selecting Clock Supply

There are two ways to supply a clock to the MCU, using the oscillator circuit of the emulation pod or using the oscillator circuit on the target system. Table 3.3 lists the factory-settings of each clock supply.

Table 3.3 Clock supply to the MCU

Clock	Description	Display of emulator debugger	Default setting
X _{IN} -X _{OUT}	Internal oscillator circuit of emulation pod (OSC-3: 16 MHz)	Internal	Yes
	Target System	External	-
X _{CIN} -X _{COUT}	Internal oscillator circuit of emulation pod (32.768 kHz)	Internal	Yes
	Target System	External	-

IMPORTANT

Notes on Changing the Clock Supply:

- The clock supply can be set by the Init dialog when starting up the emulator debugger or inputting CLK command on the script window.
- For X_{CIN}-X_{COUT} pins, it is necessary to set switches in the emulation pod. For details, refer to "3.2 Setting Switches and Pullup Resistors" (page 29).

(1) Using the Oscillator Circuit on the Target System

When turning on the power supply, the internal clock of emulation pod is selected to supply the clock to the MCU. To use the external clock on the target system, change the clock by the Init dialog when starting up the emulator debugger or the CLK command on the script window. (For details, refer to the user's manual of the emulator debugger.)

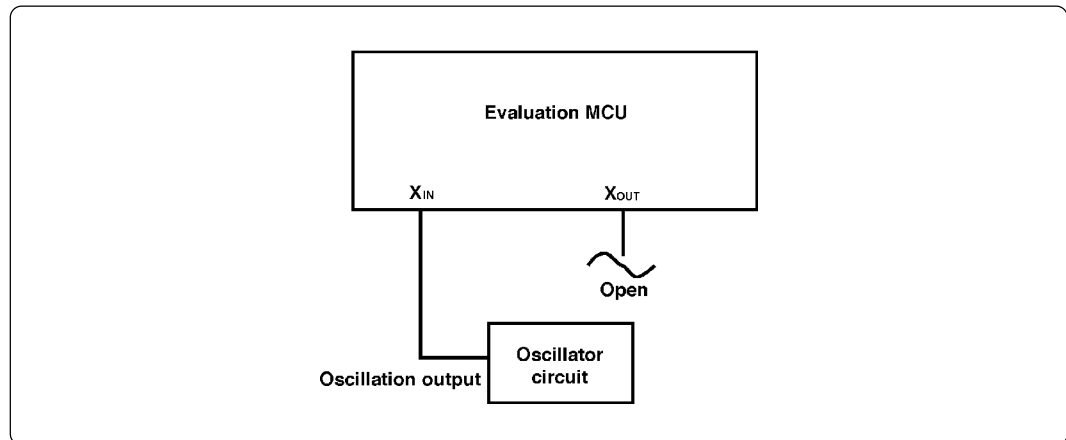


Figure 3.4 External oscillator circuit

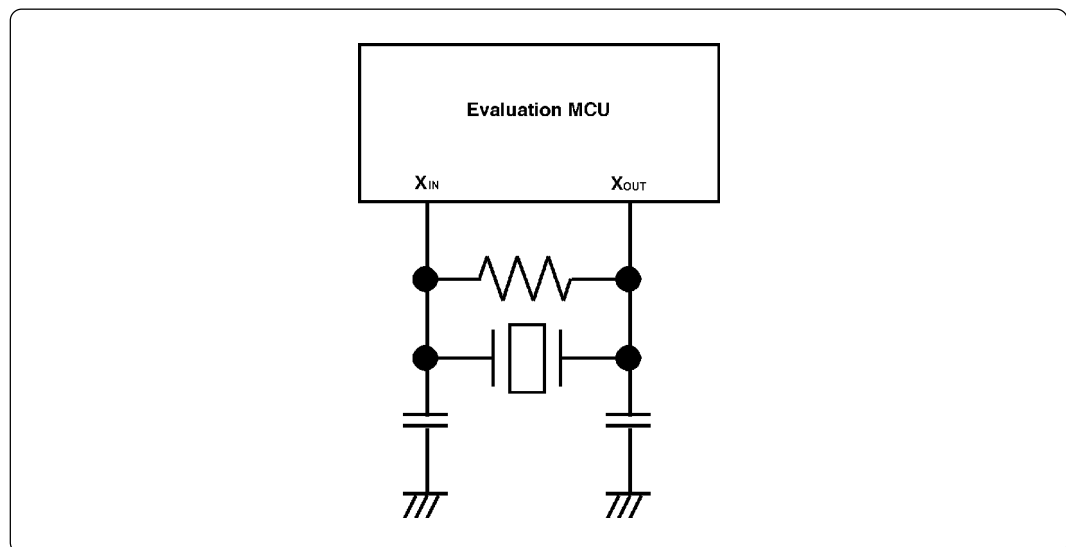


Figure 3.5 Circuit in which oscillation does not occur (same for X_{CIN} - X_{COUT})

IMPORTANT

Notes on External Clock:

- To operate the emulation pod with an external clock, construct the oscillator circuit as shown in Figure 3.4 in the target system and input the oscillator output at 50% duty (within the operating range of the evaluation MCU) into the X_{IN} pin. And the X_{OUT} pin should be open.
- Make note of the fact that in the oscillator circuit shown in Figure 3.5 where a resonator is connected between the X_{IN} and X_{OUT} pins, oscillation does not occur because a flexible cable, pitch converter board and other devices are used between the evaluation MCU and the target system. It is same for sub-clock oscillator circuits (X_{CIN} and X_{COUT}).

(2) Changing the Internal Oscillator Circuit of the Emulation Pod

An oscillator circuit board for 16 MHz is mounted on this product. To use the emulation pod at a frequency other than 16 MHz, build the desired oscillator circuit on the included OSC-2 oscillator circuit board (bare board) and replace the board installed in the emulation pod when shipped from the factory.

Figure 3.6 shows a view of the OSC-2 oscillator circuit board (bare board) and where connector pins are located. Figure 3.7 shows the circuitry of the OSC-2 oscillator circuit board (bare board). Use the number of oscillator circuits recommended by the oscillator manufacturer.

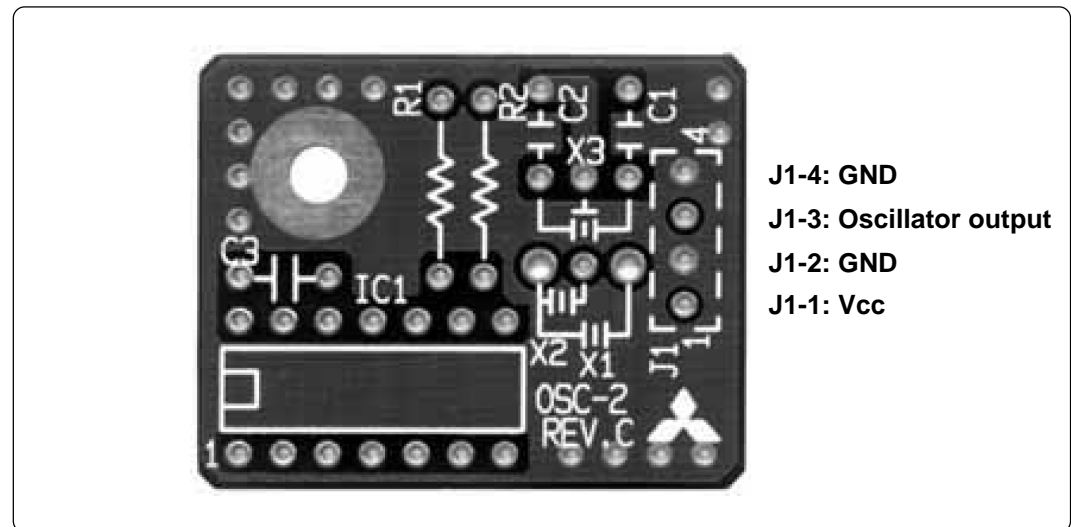


Figure 3.6 External view of oscillator board (OSC-2) and connector pin assignment

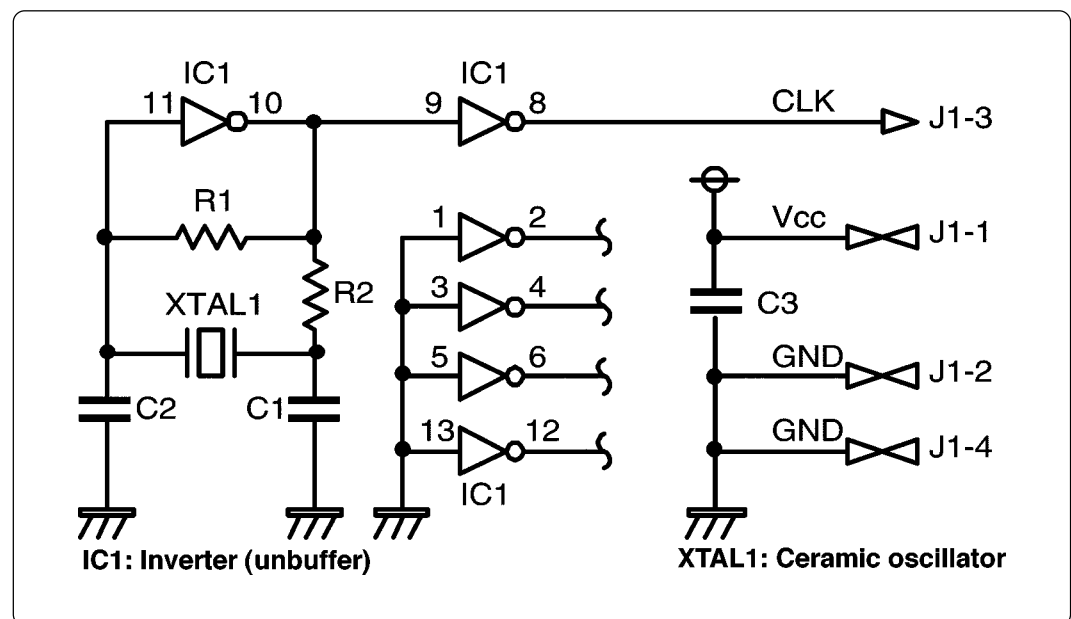


Figure 3.7 Circuit of oscillator board (OSC-2)

(3) Replacing the Oscillator Circuit Boards

Figure 3.8 shows how to replace the oscillator circuit boards. For the position of the oscillator circuit board, see Figure 2.2.

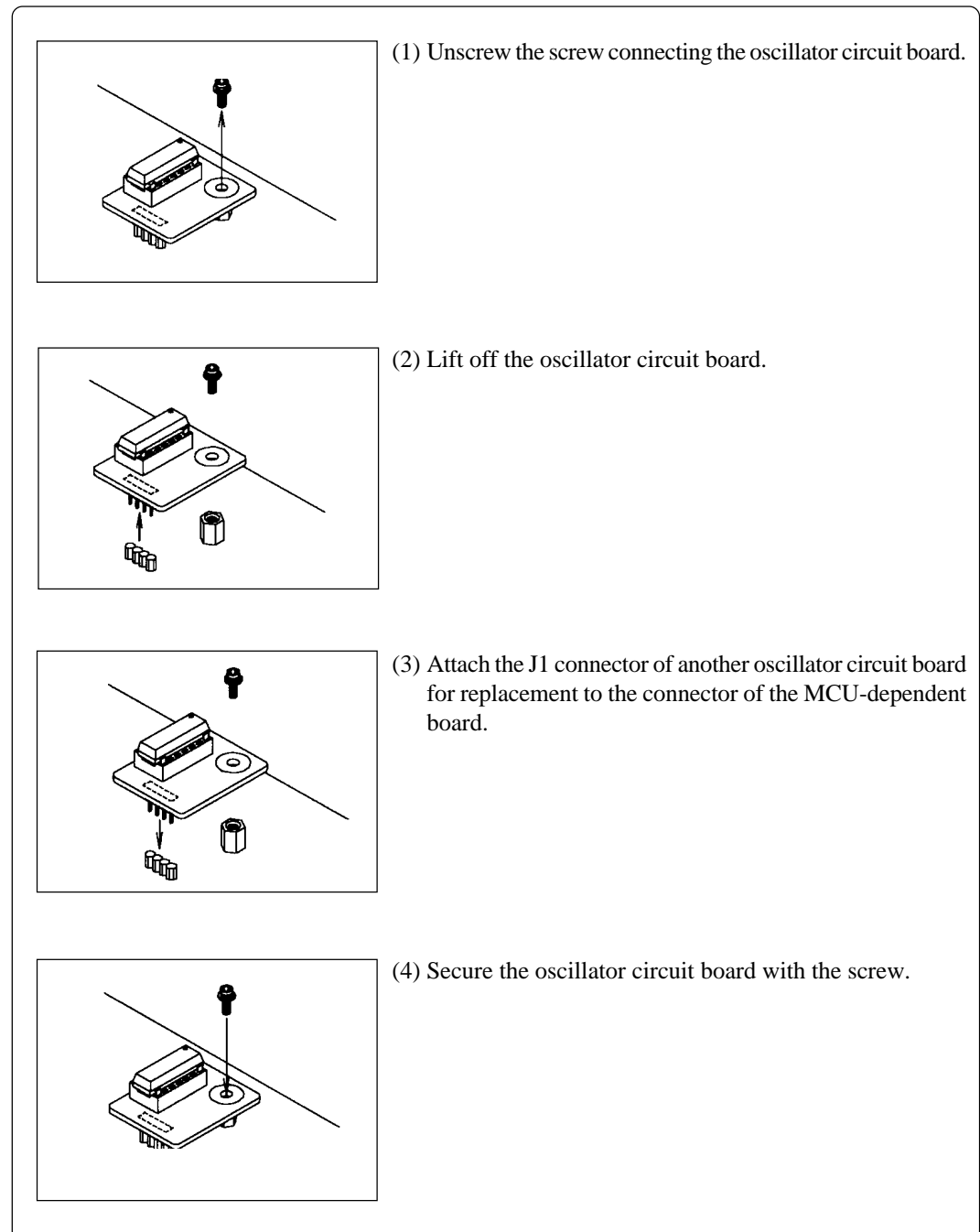


Figure 3.8 Replacing the oscillator circuit boards

3.4 A-D Conversion Bypass Capacitor

The emulation pod has foot patterns on the board for mounting a bypass capacitor. Mount a suitable bypass capacitor as occasion demands.

Figure 3.9 shows where the bypass capacitors are mounted, whereas Figure 3.10 shows an enlargement of the foot patterns.

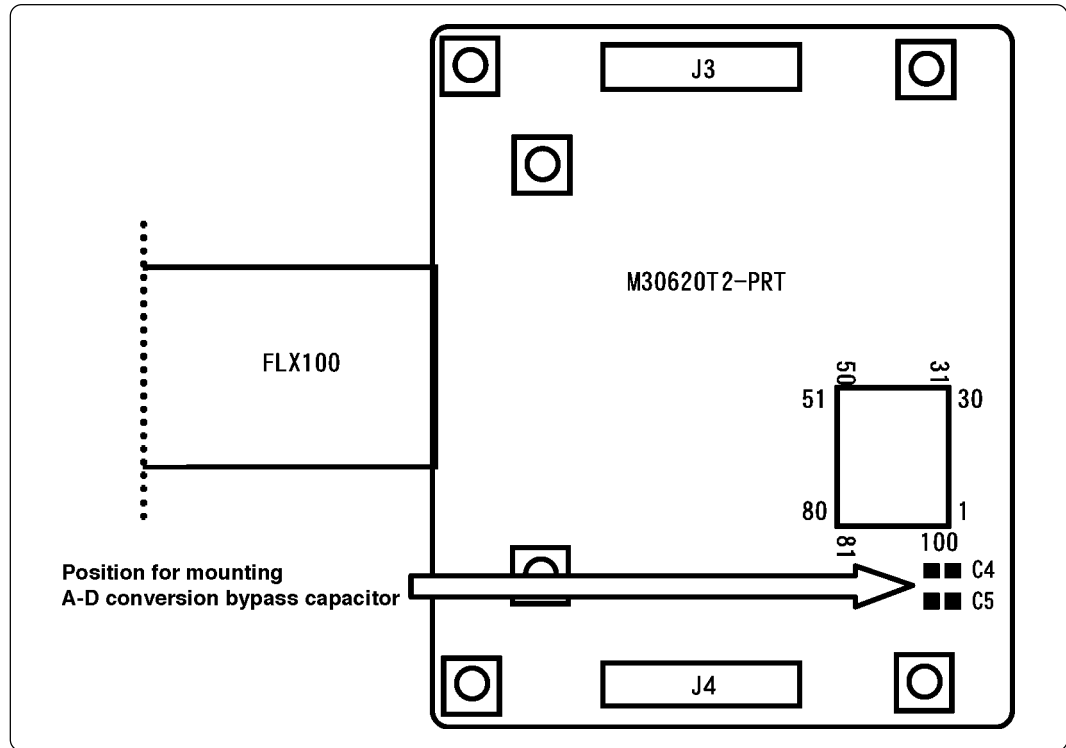


Figure 3.9 Position for mounting A-D conversion bypass capacitor (reverse side of the M30620T2-PRT)

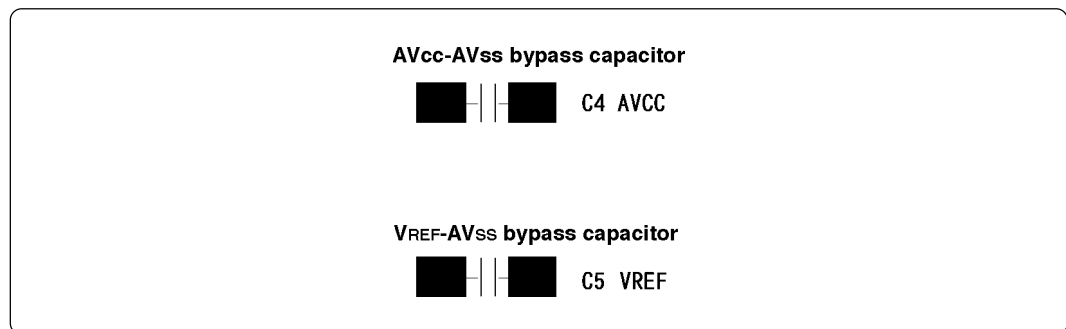


Figure 3.10 Foot patterns of A-D conversion bypass capacitor

IMPORTANT

Note on the A-D Converter:

- Because a flexible board and other devices are used between the evaluation MCU and the target system, the A-D converter operates differently from the actual MCU. Make the final evaluation of the A-D converter from the actual MCU.

3.5 Connecting the PC4701 and Emulation Pod

To connect the emulation pod to the PC4701, use the FLX120-RPD 120-pin flexible cable included in this product package. Connect the PC4701 side connector of the FLX120-RPD to the cable connector of the PC4701, then secure with screws the FLX120-RPD.

(1) Connecting the Cable to the PC4701

Figure 3.11 shows how to connect the PC4701 and FLX120-RPD.

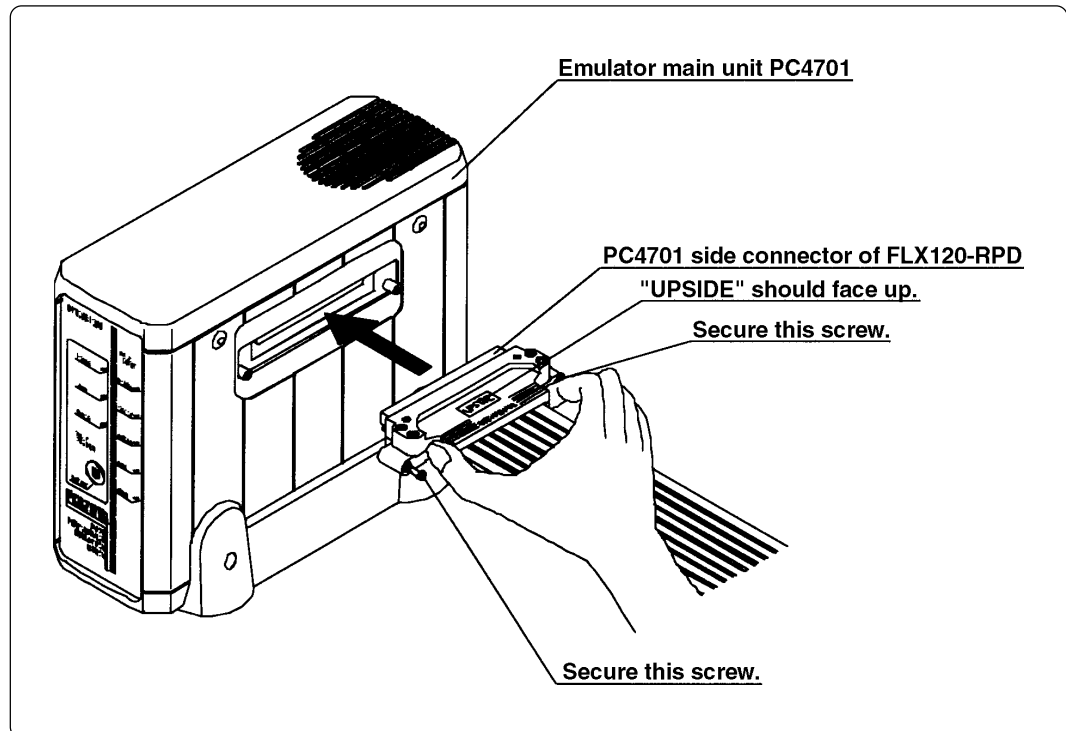


Figure 3.11 Connecting PC4701 and FLX120-RPD

CAUTION

Notes on Connecting the Cable:

- To connect the FLX120-RPD, be sure to hold the both sides of the PC4701 side connector horizontally with the "UPSIDE" facing up.
- Always shut OFF power before connecting the cable. The power ON state could destroy internal circuits.

Note on Securing the Screws:

- After connecting the cable to the emulator main unit PC4701, be sure to secure the screws mounted in both sides of the connector.

(2) Connecting the Cable to the Emulation Pod

Figure 3.12 shows how to connect the FLX120-RPD and the emulation pod.

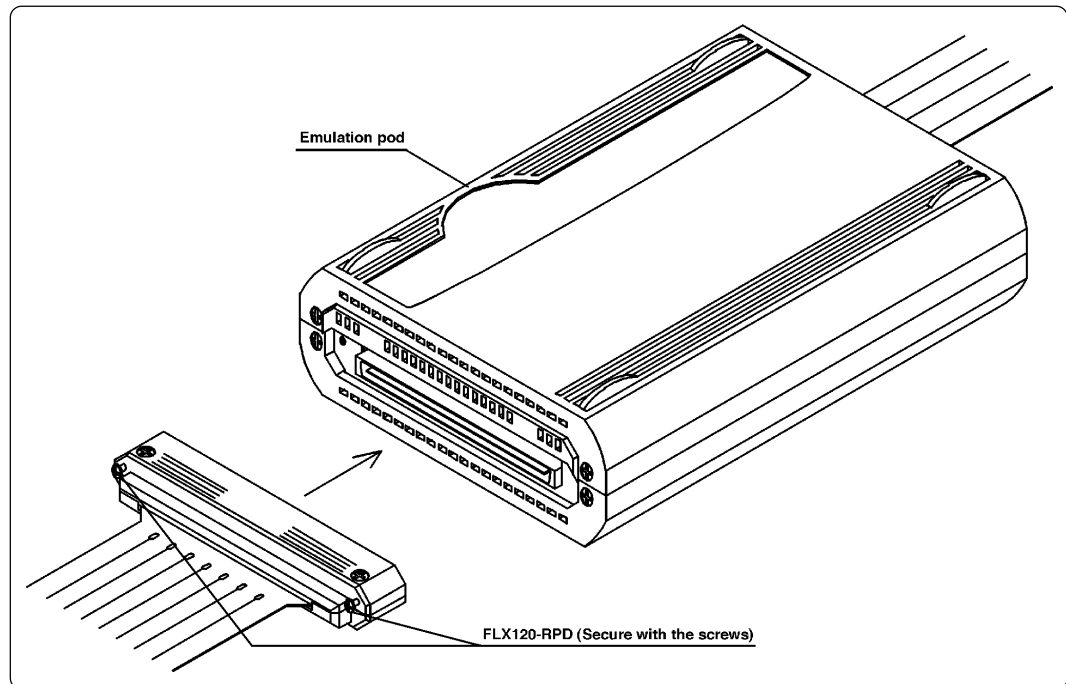


Figure 3.12 Connecting FLX120-RPD and emulation pod

CAUTION

Note on Connecting the Cable:

- Always shut OFF power before connecting the cable. The power ON state could destroy internal circuits.

Note on Securing the Screws:

- After connecting the cable to the emulation pod, be sure to secure the screws.

3.6 Connecting the Target System

Figure 3.13 shows how to connect this product to the target system.

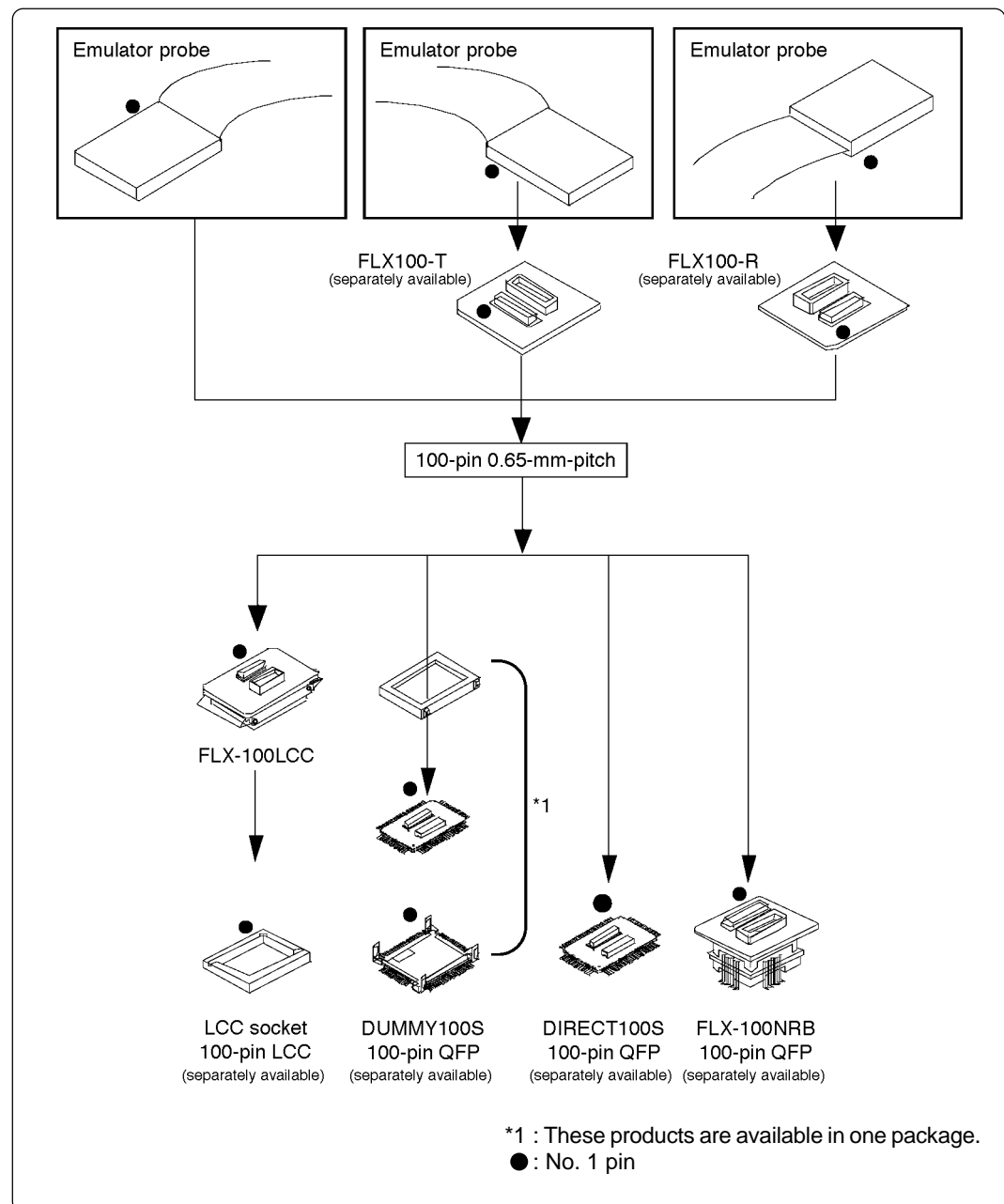


Figure 3.13 Connecting emulation pod and target systems

CAUTION

Notes on Connecting the Target System:

- Take care not to attach the converter board in a wrong direction. It may cause a fatal damage to the emulation pod.
- The small connectors of the FLX100 and FLX-100LCC are guaranteed for only 20 insertion/removal iterations.

(1) Connecting 100-pin 0.65-mm-pitch LCC Socket

When connecting the emulation pod probe to the 100-pin LCC socket (Yamaichi Electronics Co., Ltd. IC61-1004-051 etc.) on the target system, following the procedure below.

- (1) Attach the FLX100 to the FLX-100LCC.
- (2) Attach the FLX-100LCC to the 100-pin LCC socket.

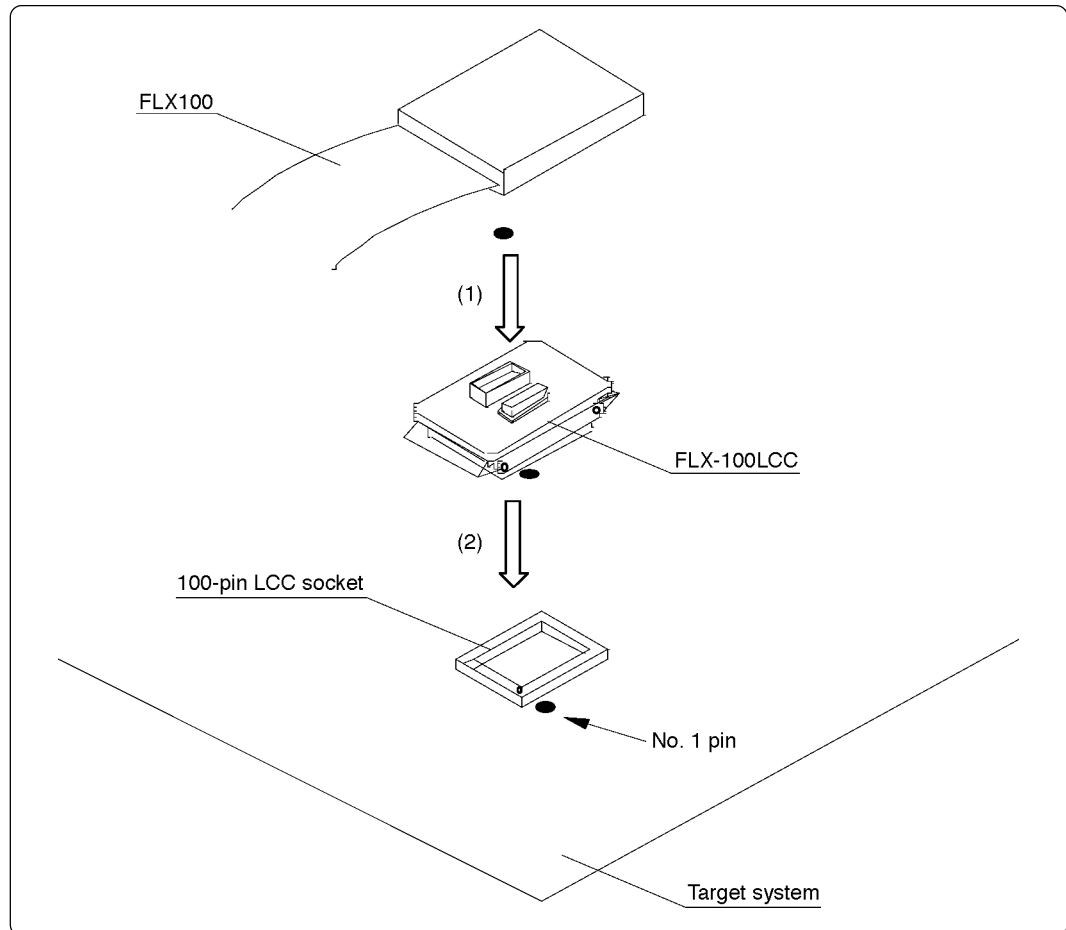


Figure 3.14 Connecting a 100-pin 0.65-mm-pitch LCC socket

CAUTION

Notes on Connecting Target System:

- Take care not to attach the converter board in a wrong direction. It may cause a fatal damage to the emulation pod.
- The small connector of the FLX100 and FLX-100LCC are guaranteed for only 20 insertion/removal iterations.
- For purchasing the IC61-1004-051 and for any inquiry for it, contact Yamaichi Electronics Co., Ltd.

(2) Connecting 100-pin 0.65-mm-pitch Foot Pattern (Part 1)

Figure 3.15 shows how to connect the emulation pod probe to the 100-pin 0.65-mm-pitch QFP (100P6S-A) foot pattern on the target system with the DUMMY100S (not included), and here following is its procedure. For details on the DUMMY100S, refer to its user's manual.

- (1) Attach the DUMMY100S to the target system.
- (2) Attach the FLX-100LCC to the DUMMY100S.

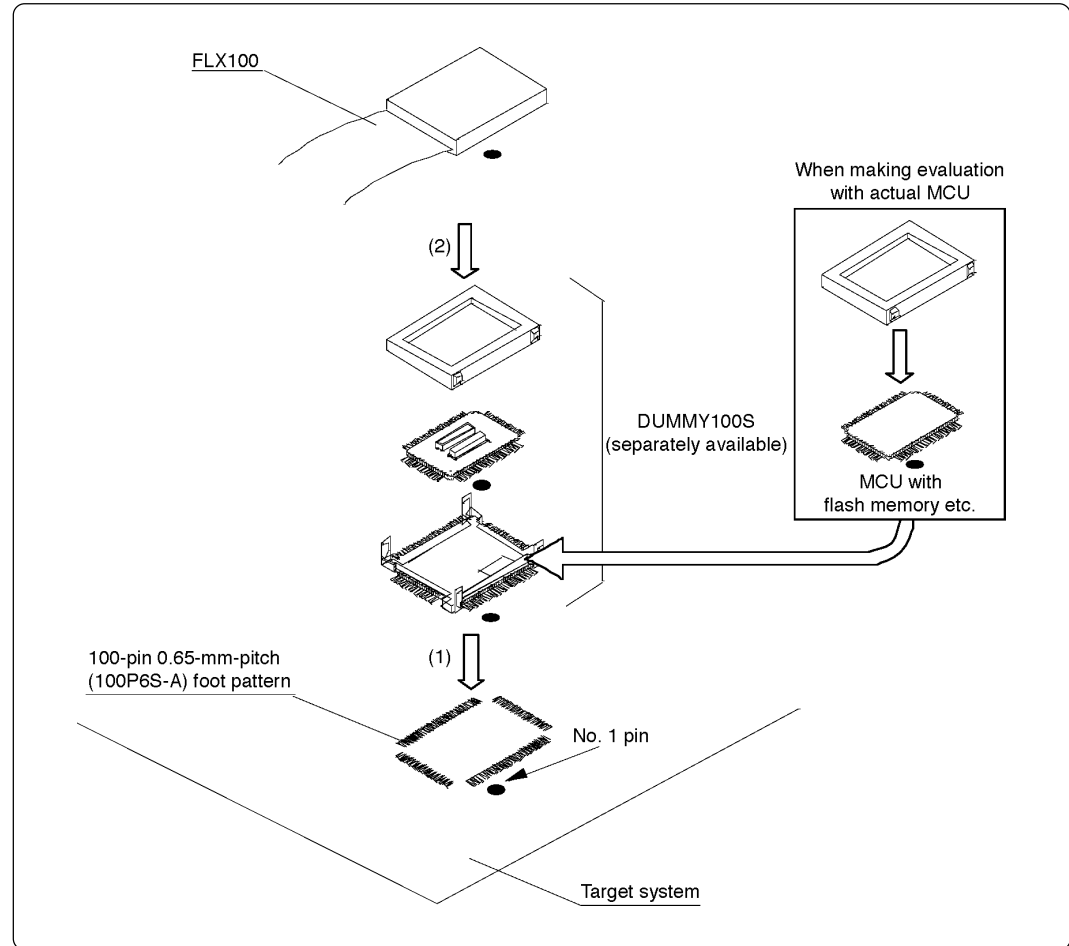


Figure 3.15 Connecting a 100-pin 0.65-mm-pitch foot pattern (part 1)

CAUTION

Notes on Connecting the Target System:

- Take care not to attach the converter board in a wrong direction. It may cause a fatal damage to the emulation pod.
- The small connectors of the DUMMY100S and FLX100 are guaranteed for only 20 insertion/removal iterations.

(3) Connecting 100-pin 0.65-mm-pitch Foot Pattern (Part 2)

Figure 3.16 shows how to connect the emulation pod probe to the 100-pin 0.65-mm-pitch QFP (100P6S-A) foot pattern on the target system with the DIRECT100S (not included), and here following is its procedure. For details on the DIRECT100S, refer to its user's manual.

- (1) Attach the DIRECT100S to the target system.
- (2) Attach the FLX-100LCC to the DIRECT100S.

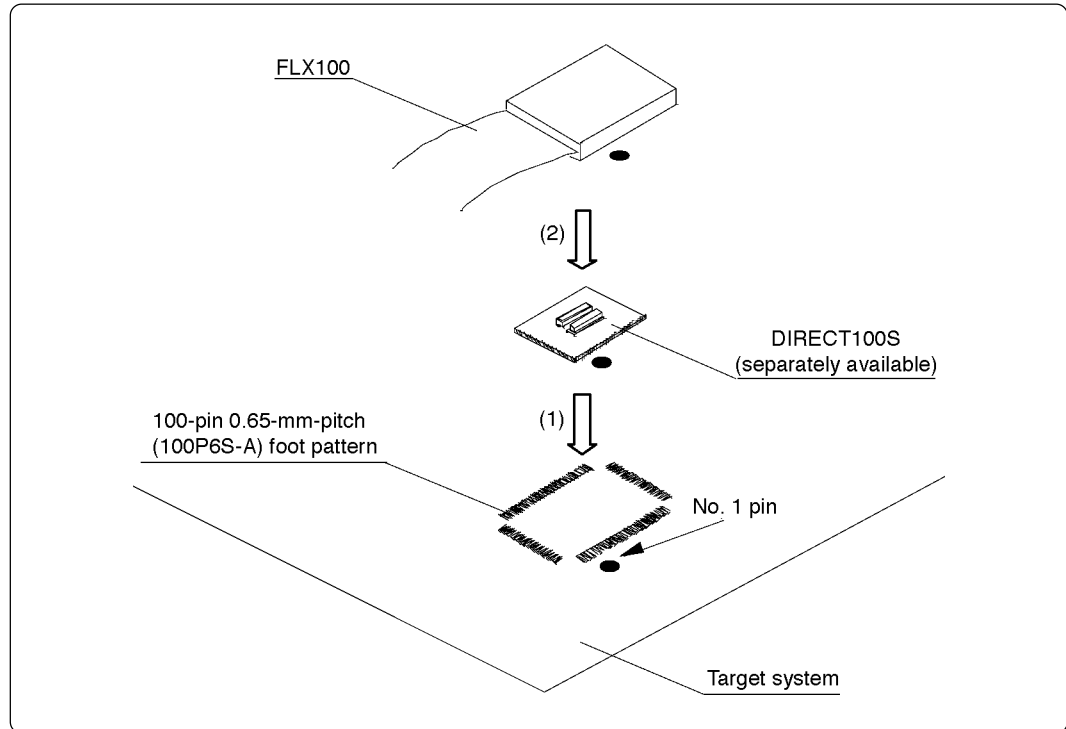


Figure 3.16 Connecting a 100-pin 0.65-mm-pitch foot pattern (part 2)

CAUTION

Notes on Connecting the Target System:

- Take care not to attach the converter board in a wrong direction. It may cause a fatal damage to the emulation pod.
- The small connectors of the DIRECT100S and FLX100 are guaranteed for only 20 insertion/removal iterations.

(4) Connecting 100-pin 0.65-mm-pitch Foot Pattern (Part 3)

Figure 3.17 shows how to connect the emulation pod probe to the 100-pin 0.65-mm-pitch QFP (100P6S-A) foot pattern on the target system with the FLX-100NRB (not included), and here following is its procedure. For details on the FLX-100NRB, refer to its user's manual.

- (1) Attach the FLX-100NRB to the target system.
- (2) Attach the FLX-100LCC to the FLX-100NRB.

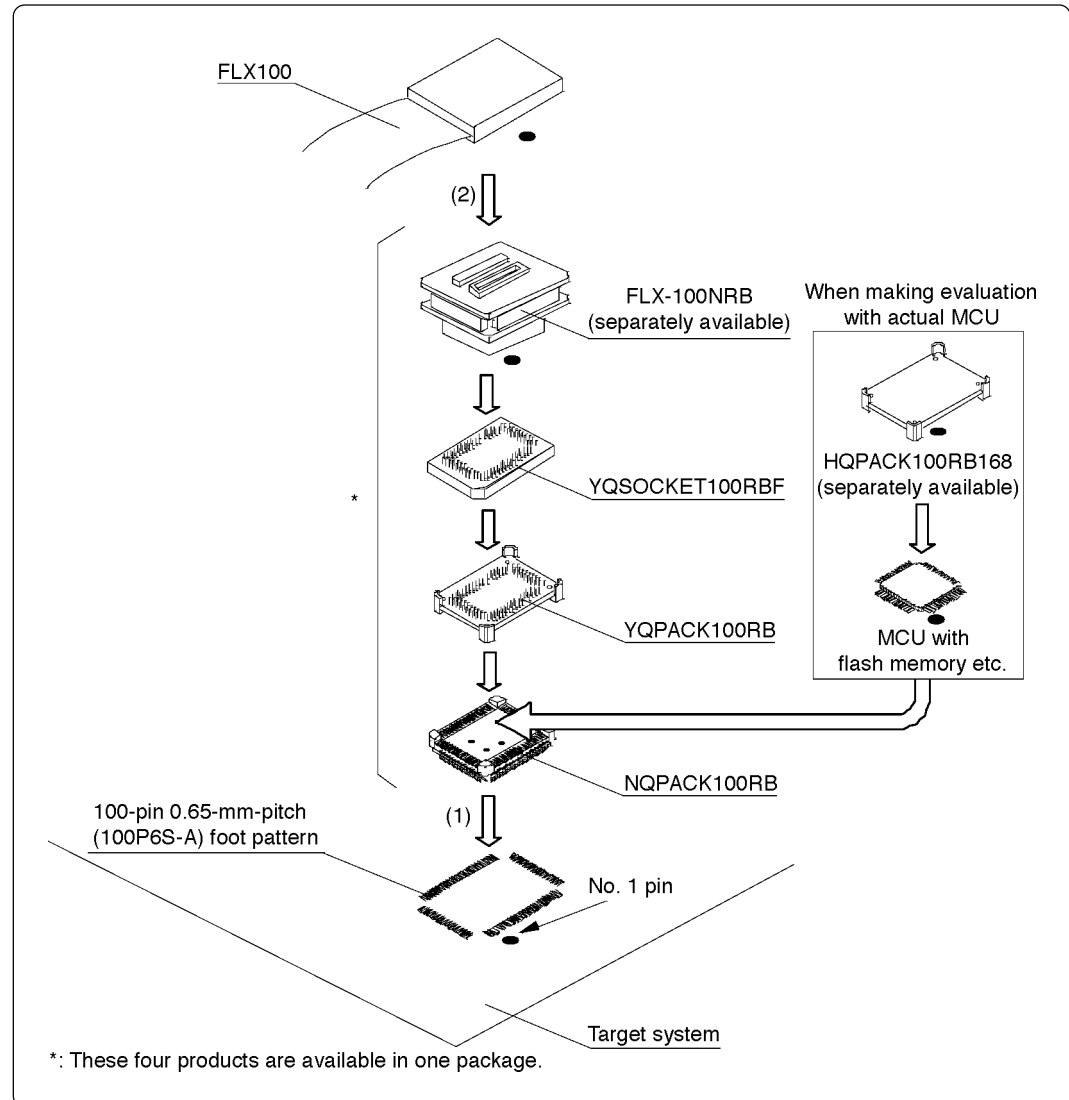


Figure 3.17 Connecting a 100-pin 0.65-mm-pitch foot pattern (part 3)

CAUTION

Notes on Connecting the Target System:

- Take care not to attach the converter board in a wrong direction. It may cause a fatal damage to the emulation pod.
- The small connectors of the FLX-100NRB and FLX100 are guaranteed for only 20 insertion/removal iterations.

3.7 Procedure for Making MCU File for PD30

It is necessary to change the contents of the MCU file according to the MCU to be developed. Make the MCU file "M306N0.MCU" for M306N0 Group and "M306N1.MCU" for M306N1 Group and store it in the "mcufiles" folder in the directory same as emulator debugger PD30 is stored. For PD30 Ver.4.10 or earlier, store the MCU file in the folder same as emulator debugger PD30.

The contents of the MCU file (the SFR area, internal RAM area, internal ROM area, the name of firmware file) are shown below. Change the settings according to the MCU to be debugged. Use your text editor for changing the contents of the MCU file.

The contents of the MCU file are as follows:

(1) For 306N0MCT: 5 KB of RAM and 128 KB of ROM (file name: M306N0.MCU)

0	: SFR area	Start address
3FF	:	End address
400	: Internal RAM	Start address
17FF	:	End address
E0000	: Internal ROM	Start address
FFFFF	:	End address
M30620B	: Name of firmware	(Do not change.)
0	: Expansion No.	PD30 V.4.00 or later required (Do not change.)

(2) For M306N0FGT: 10 KB of RAM and 256 KB of ROM (file name: M30221.MCU)

0	: SFR area	Start address
3FF	:	End address
400	: Internal RAM	Start address
2BFF	:	End address
C0000	: Internal ROM	Start address
FFFFF	:	End address
M30620B	: Name of firmware	(Do not change.)
0	: Expansion No.	PD30 V.4.00 or later required (Do not change.)

MEMO

Chapter 4. Usage

This chapter describes from turning on the power of this product to starting up the emulator debugger.

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Chapter 4. Usage

4.1 Turning On the Power

(1) Checking the Connection of Emulator System

Before turning the power ON, check the connection of the PC4701, emulation pod, converter board and target system.

(2) Turning On the Power

Power ON/OFF the target system and the PC4701 as simultaneously as possible.

CAUTION

Notes on Power Supply:

- The emulator's V_{CC} pin is connected to the target system in order to monitor target system voltage. For this reason, the emulator cannot supply power to the target system. Therefore, provide the target system with a separate power supply from that of the emulator.
- Keep target system power supply voltage within the MCU's specified range.
- Do not change target system power supply voltage after power has been activated.

(3) LED Display When PC4701 Starts Up Normally

After the emulator starts up, check the status of the LEDs on the front panel to see whether emulation pod operation is enabled or not. Figure 4.1 shows front panel LED lighting status when the emulator is turned ON.

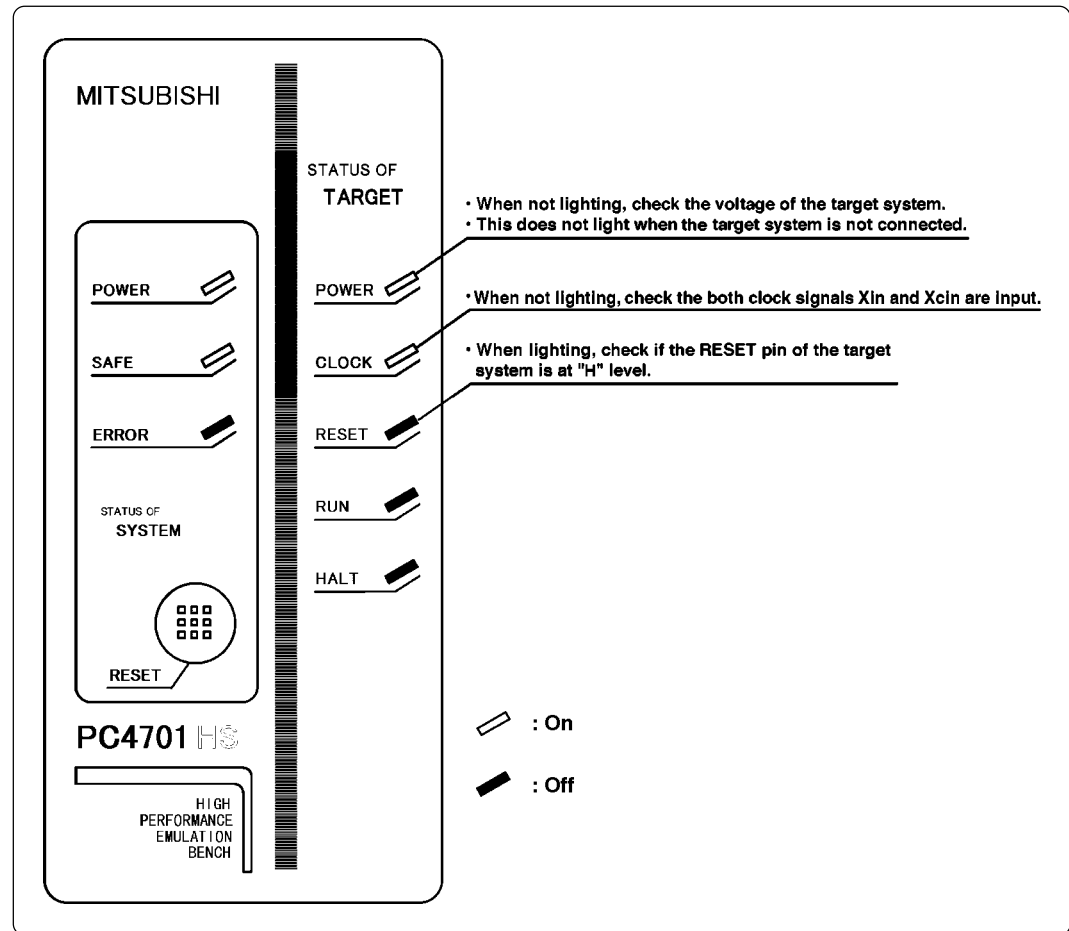


Figure 4.1 LED display when the power turned on

IMPORTANT

Note on Memory Expansion Mode and Microprocessor Mode:

- To use the memory expansion or microprocessor mode, be sure to set the RDY*, HOLD* and NMI* pins so that they are not active at start-up. Otherwise the emulator system will not function correctly.

Note on CLOCK LED:

- If CLOCK LED does not turn on, check the following points:
 - Immediately after starting PC4701 (before starting the emulator debugger)
--> Check if the oscillation circuit within the emulation pod oscillates normally.
 - After starting the emulator debugger (after setting the Init dialog)
--> Check the oscillation circuit set in the Init dialog oscillates normally.

4.2 Downloading Firmware

(1) When It is Necessary to Download Firmware

It is necessary to download firmware when:

- (1) you use this product for the first time
- (2) the firmware has been upgraded
- (3) the emulator debugger has been upgraded
- (4) you use this product with a PC4701 which was used with other emulation pod before

(2) Downloading Firmware in the Maintenance Mode

Download the firmware in the maintenance mode as explained here following. The target system must not be connected when downloading the firmware.

- (1) Within 2 seconds of activating power to the emulator, press the RESET switch on the emulator front panel. This will switch the emulator to the maintenance mode.
- (2) Start up the emulator debugger. When the Init dialog box setup is complete, the dialog which urges to download the firmware will appear. Download the firmware following messages. Required time for downloading the firmware depends on the connection of the interface.
 - For the serial interface approx. 7 minutes
 - For the parallel interface approx. 30 seconds

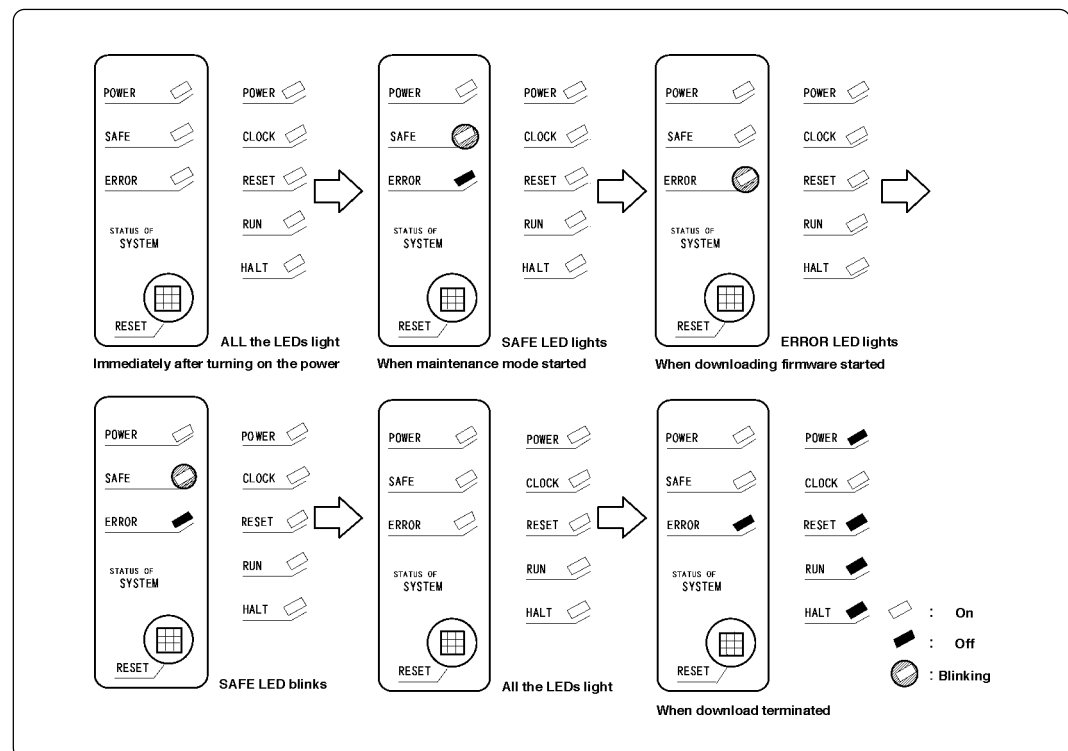


Figure 4.2 Downloading firmware in the maintenance mode

IMPORTANT

Note on Downloading Firmware:

- Do not shut OFF power while the firmware is being downloaded. Doing so, the emulator will not start up properly. If power is shut OFF by mistake, redownload the firmware in the maintenance mode.

4.3 Self-checks

(1) Self-check Procedure

To run the emulator self-checks, do so as explained here below. While self-checks are in progress, LEDs will change as shown in Figure 4.4.

- (1) Set the switches in the emulation pod same as the factory-setting (see Figure 4.3).
- (2) When the target system is connected, disconnect the target system.
- (3) Within 2 seconds of activating power to the emulator, press the RESET switch on the emulator front panel to switch the emulator to the maintenance mode.
- (4) Check the "SAFE" LED starts blinking and then press the RESET switch again.
- (5) The self-checks will start. If the normal result is displayed in about 40 seconds, self-checks terminated normally.

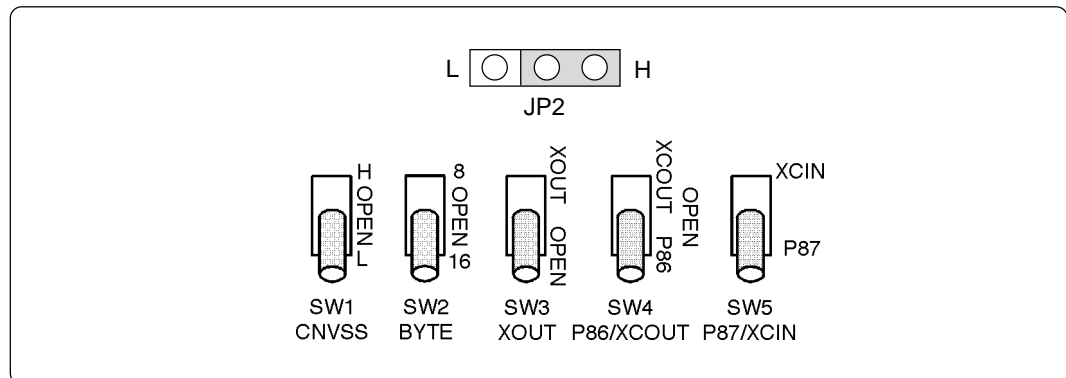


Figure 4.3 Switch settings when running self-checks (factory-settings)

(2) If an Error is Detected in Self-checks

If self-checks do not result normally (system status error or target status error in Figure 4.4), check the following.

- Check the connection of the emulation pod and the PC4701.
- Download the proper firmware.
- Check if the switches in this product are set same as the factory-settings (Figure 4.3).

IMPORTANT

Note on Self-checks:

- If self-checks do not result normally (excluding target system errors), the emulation pod may be damaged. Then contact your distributor.

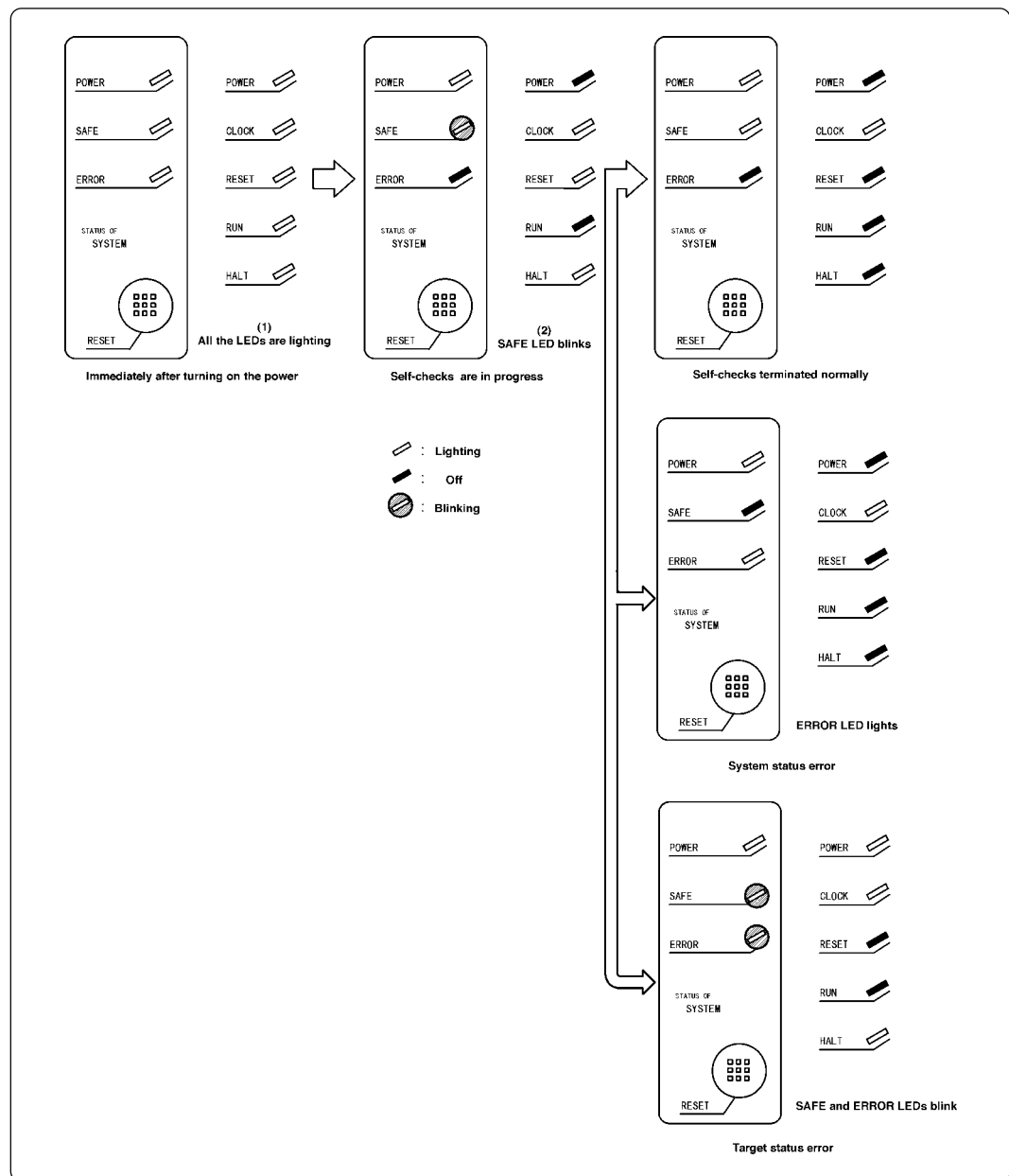


Figure 4.4 Self-check procedure

Chapter 5. Specifications

This chapter describes specifications of this product.

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Chapter 5. Specifications

5.1 Specifications

Table 5.1 lists the specifications of M306N0T2-RPD-E.

Table 5.1 Specifications of the M306N0T2-RPD-E

Emulator	PC4701	
Applicable MCUs	M306N0 and M306N1	
Evaluation MCU	M30622SAFP x1, M306N0MC-TOOL x1	
Usable modes	Single-chip mode Memory expansion mode Microprocessor mode	
Emulation memory	1 MB	
Maximum operating frequency	No-wait	5.0 V: 16.0 MHz, 1/1 pre-scaler 20.0 MHz, 1/2 pre-scaler
	1-wait	5.0 V: 16.0 MHz, 1/1 pre-scaler 20.0 MHz, 1/2 pre-scaler
Clock supply	X _{IN} -X _{OUT}	Internal oscillator circuit board (OSC-3) Switchable to external oscillator input.
	X _{CIN} -X _{COU} T	Internal oscillator circuit board Switchable to external oscillator input.
Operating voltage	4.2 to 5.5 V	
Operating temperature	5 to 35°C (no dew)	
Storage temperature	-10 to 60°C (no dew)	
Power supply to emulation pod	Supplied from PC4701	
Connection to target system See "3.6 Connecting the Target System" (page 40).	<ul style="list-style-type: none">• 100-pin 0.65-mm-pitch QFP (100P6S-A):<ul style="list-style-type: none">(1) DUMMY100S (separately available)(2) DIRECT100S (separately available)(3) FLX-100NRB (separately available)• 100-pin LCC socket: FLX-100LCC (included)	
International standards	<ul style="list-style-type: none">• U.S. EMI standards (FCC part 15 Class A)• CE marking (EN55022, EN50082-1)	

5.2 Operation Timing in Memory Expansion Mode and Microprocessor Mode (5 V)

(1) Separate Bus, No-Wait

Table 5.2 and Figure 5.1 show the bus timing in the memory expansion mode and the microprocessor mode (separate bus, no-wait).

Table 5.2 Memory expansion mode and microprocessor mode (separate bus, no-wait)

Symbol	Item	Actual MCU (ns)		This product (ns)	
		Min.	Max.	Min.	Max.
Td (BCLK-AD)	Address output delay time		25		See left
Th (BCLK-AD)	Address output hold time (BCLK standard)	4		See left	
Th (RD-AD)	Address output hold time (RD standard)	0		See left	
Th (WR-AD)	Address output hold time (WR standard)	0		See left	
Td (BCLK-CS)	Chip-select output delay time		25		See left
Th (BCLK-CS)	Chip-select output hold time (BCLK standard)	4		See left	
Td (BCLK-ALE)	ALE signal output delay time		25		See left
Th (BCLK-ALE)	ALE signal output hold time	-4		See left	
Td (BCLK-RD)	RD signal output delay time		25		See left
Th (BCLK-RD)	RD signal output hold time	0		See left	
Td (BCLK-WR)	WR signal output delay time		25		See left
Th (BCLK-WR)	WR signal output hold time	0		See left	
Td (BCLK-DB)	Data output delay time (BCLK standard)		40		See left
Th (BCLK-DB)	Data output hold time (BCLK standard)	4		See left	
Td (DB-WR)	Data output delay time (WR standard)	(*1)		See left	
Th (WR-DB)	Data output hold time (WR standard)	0		See left	

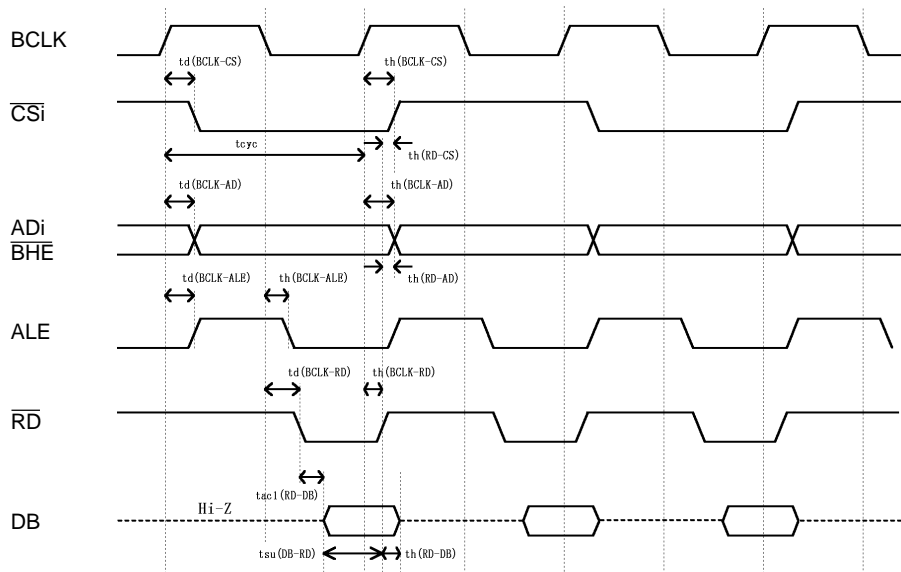
*1 Calculated by the following formula according to the frequency of BCLK.

$$Td (DB-WR) = \frac{10^9}{f(BCLK) \times 2} - 40 \text{ (ns)}$$

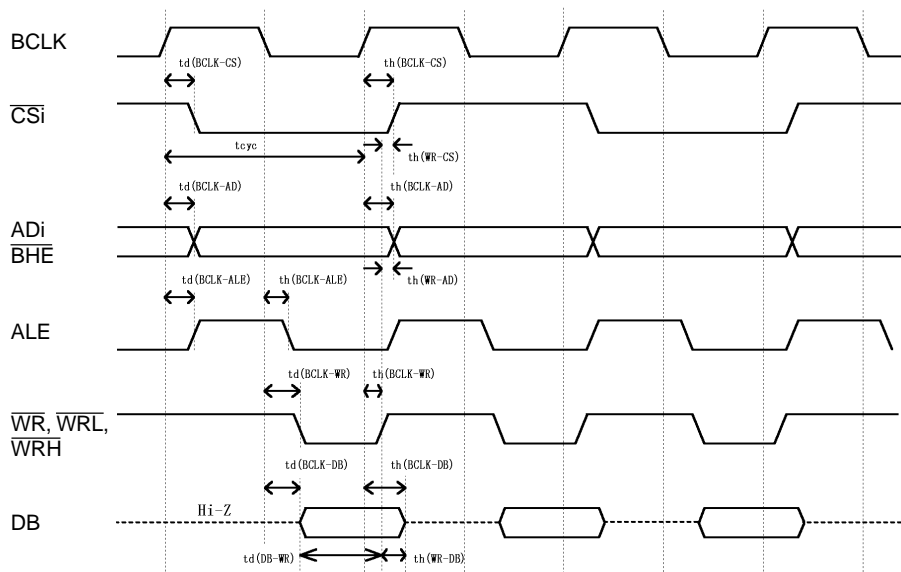
$V_{CC} = 5\text{ V}$

Memory expansion mode and microprocessor mode (no-wait)

Read timing



Write timing



Conditions:

- $V_{CC} = 5\text{ V}$
- Input timing voltage: $V_{IL} = 0.8\text{ V}$, $V_{IH} = 2.5\text{ V}$
- Output timing voltage: $V_{OL} = 0.8\text{ V}$, $V_{OH} = 2.0\text{ V}$

Figure 5.1 Memory expansion mode and microprocessor mode (no-wait)

(2) Separate Bus, With Wait, Accessing External Memory Area

Table 5.3 and Figure 5.2 show the bus timing in the memory expansion mode and the microprocessor mode (with wait, accessing external memory area).

Table 5.3 Memory expansion mode and microprocessor mode (with wait, external memory area)

Symbol	Item	Actual MCU (ns)		This product (ns)	
		Min.	Max.	Min.	Max.
Td (BCLK-AD)	Address output delay time		25		See left
Th (BCLK-AD)	Address output hold time (BCLK standard)	4		See left	
Th (RD-AD)	Address output hold time (RD standard)	0		See left	
Th (WR-AD)	Address output hold time (WR standard)	0		See left	
Td (BCLK-CS)	Chip-select output delay time		25		See left
Th (BCLK-CS)	Chip-select output hold time (BCLK standard)	4		See left	
Td (BCLK-ALE)	ALE signal output delay time		25		See left
Th (BCLK-ALE)	ALE signal output hold time	-4		See left	
Td (BCLK-RD)	RD signal output delay time		25		See left
Th (BCLK-RD)	RD signal output hold time	0		See left	
Td (BCLK-WR)	WR signal output delay time		25		See left
Th (BCLK-WR)	WR signal output hold time	0		See left	
Td (BCLK-DB)	Data output delay time (BCLK standard)		40		See left
Th (BCLK-DB)	Data output hold time (BCLK standard)	4		See left	
Td (DB-WR)	Data output delay time (WR standard)	(*1)		See left	
Th (WR-DB)	Data output hold time (WR standard)	0		See left	

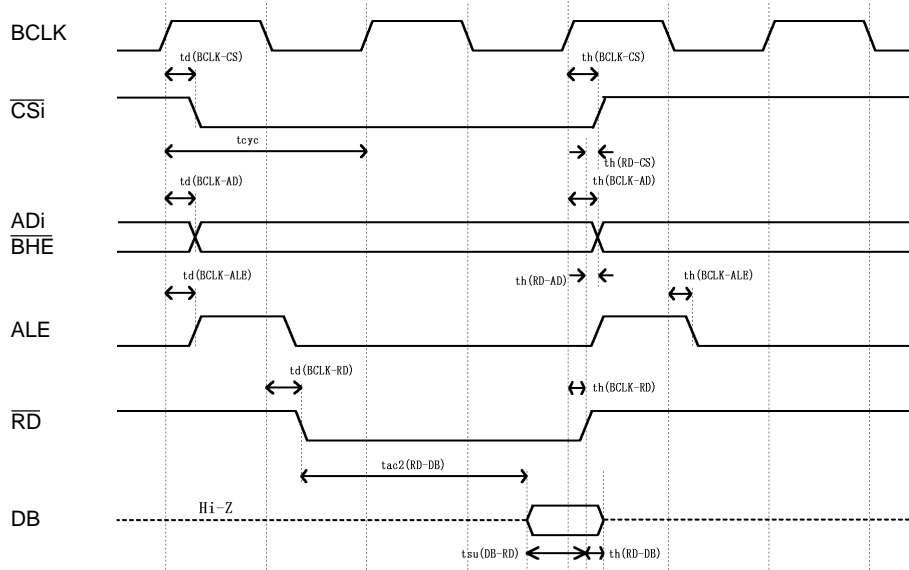
*1 Calculated by the following formula according to the frequency of BCLK.

$$Td (DB-WR) = \frac{10^9}{f(BCLK)} - 40 \text{ (ns)}$$

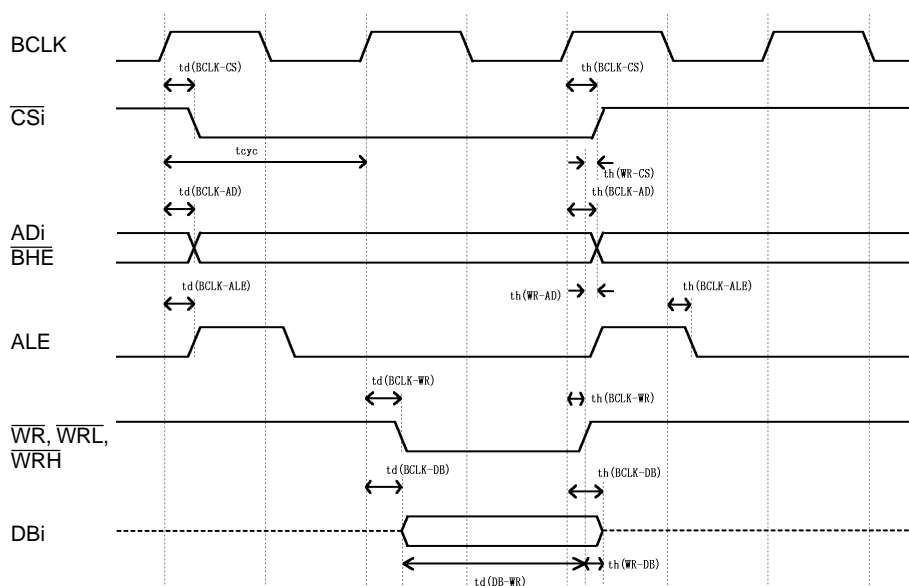
$V_{CC} = 5\text{ V}$

Memory expansion mode and microprocessor mode (with wait, accessing external memory area)

Read timing



Write timing



Conditions:

- $V_{CC} = 5\text{ V}$
- Input timing voltage: $V_{IL} = 0.8\text{ V}$, $V_{IH} = 2.5\text{ V}$
- Output timing voltage: $V_{OL} = 0.8\text{ V}$, $V_{OH} = 2.0\text{ V}$

Figure 5.2 Memory expansion mode and microprocessor mode (with wait)

(3) Multiplex Bus, With Wait, Accessing External Memory Area

Table 5.4 and Figure 5.3 show the bus timing in the memory expansion mode and the microprocessor mode (with wait, accessing external memory area and using multiplex bus).

Table 5.4 Memory expansion mode and microprocessor mode (with wait, multiplex bus)

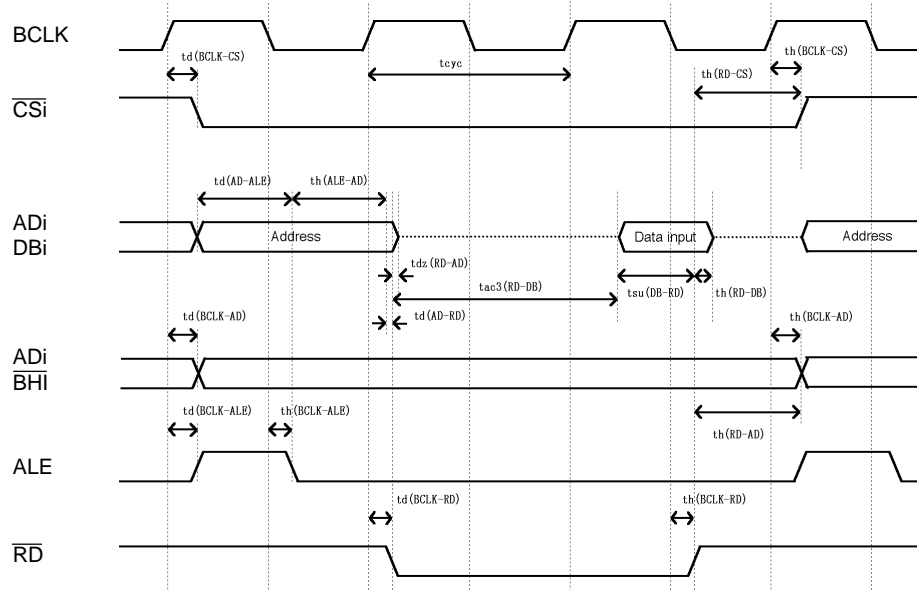
Symbol	Item	Actual MCU (ns)		This product (ns)	
		Min.	Max.	Min.	Max.
Td (BCLK-AD)	Address output delay time		25		See left
Th (BCLK-AD)	Address output hold time (BCLK standard)	4		See left	
Th (RD-AD)	Address output hold time (RD standard)	(*1)		(*2)	
Th (WR-AD)	Address output hold time (WR standard)	(*1)		(*2)	
Td (BCLK-CS)	Chip-select output delay time		25		See left
Th (BCLK-CS)	Chip-select output hold time (BCLK standard)	4		See left	
Th (RD-CS)	Chip-select output hold time (RD standard)	(*1)		(*2)	
Th (WR-CS)	Chip-select output hold time (WR standard)	(*1)		(*2)	
Td (BCLK-RD)	RD signal output delay time		25		See left
Th (BCLK-RD)	RD signal output hold time	0		See left	
Td (BCLK-WR)	WR signal output delay time		25		See left
Th (BCLK-WR)	WR signal output hold time	0		See left	
Td (BCLK-DB)	Data output delay time (BCLK standard)		40		See left
Th (BCLK-DB)	Data output hold time (BCLK standard)	4		See left	
Td (DB-WR)	Data output delay time (WR standard)	(*1)		See left	
Th (WR-DB)	Data output hold time (WR standard)	(*1)		(*2)	
Td (BCLK-ALE)	ALE output delay time (BCLK standard)		25		See left
Th (BCLK-ALE)	ALE output hold time (BCLK standard)	-4		See left	
Td (AD-ALE)	ALE output delay time (Address standard)	(*1)		See left	
Th (ALE-AD)	ALE output hold time (Address standard)	50		See left	
Td (AD-RD)	After address RD signal output delay time	0		See left	
Td (AD-WR)	After address WR signal output delay time	0		See left	
Tdz (RD-AD)	Address output floating start time		8		See left

*1 Calculated by the following formulas according to the frequency of BCLK.	*2 Calculated by the following formulas according to the frequency of BCLK.
$Th (RD-AD) = \frac{10^9}{f(BCLK) \times 2} \text{ (ns)}$	$Th (RD-AD) = \frac{10^9}{f(BCLK) \times 2} - 6 \text{ (ns)}$
$Th (WR-AD) = \frac{10^9}{f(BCLK) \times 2} \text{ (ns)}$	$Th (WR-AD) = \frac{10^9}{f(BCLK) \times 2} - 6 \text{ (ns)}$
$Th (RD-CS) = \frac{10^9}{f(BCLK) \times 2} \text{ (ns)}$	$Th (RD-CS) = \frac{10^9}{f(BCLK) \times 2} - 3 \text{ (ns)}$
$Th (WR-CS) = \frac{10^9}{f(BCLK) \times 2} \text{ (ns)}$	$Th (WR-CS) = \frac{10^9}{f(BCLK) \times 2} - 3 \text{ (ns)}$
$Td (DB-WR) = \frac{10^9 \times 3}{f(BCLK) \times 2} - 40 \text{ (ns)}$	
$Th (WR-DB) = \frac{10^9}{f(BCLK) \times 2} \text{ (ns)}$	$Th (RD-AD) = \frac{10^9}{f(BCLK) \times 2} - 6 \text{ (ns)}$
$Td (AD-ALE) = \frac{10^9}{f(BCLK) \times 2} - 25 \text{ (ns)}$	

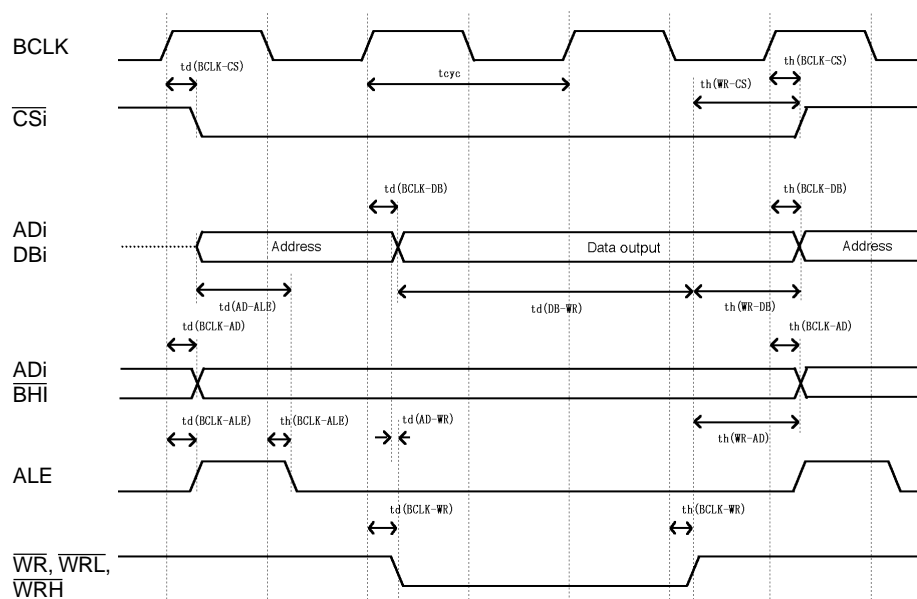
$V_{CC} = 5\text{ V}$

Memory expansion mode and microprocessor mode
(with wait, accessing external memory area and using multiplex bus)

Read timing



Write timing



Conditions:

- $V_{CC} = 5\text{ V}$
- Input timing voltage: $V_{IL} = 0.8\text{ V}$, $V_{IH} = 2.5\text{ V}$
- Output timing voltage: $V_{OL} = 0.8\text{ V}$, $V_{OH} = 2.0\text{ V}$

Figure 5.3 Memory expansion mode and microprocessor mode (with wait, multiplex bus)

(4) Timing Requirements

Table 5.5, Figures 5.4 and 5.5 show timing requirements in the memory expansion mode and the microprocessor mode.

Table 5.5 Timing requirements ($V_{CC} = 5\text{ V}$)

Symbol	Item	Actual MCU (ns)		This product (ns)	
		Min.	Max.	Min.	Max.
Tsu (DB-RD)	Data input setup time	40		See left	
Tsu (RDY-BCLK)	RDY* input setup time	30		See left	
Tsu (HOLD-BCLK)	HOLD* input setup time	40		(*1)	
Th (RD-DB)	Data input hold time	0		See left	
Th (BCLK-RDY)	RDY* input hold time	0		See left	
Th (BCLK-HOLD)	HOLD* input hold time	0		See left	
Td (BCLK-HLDA)	HLDA* output delay time		40		See left

*1 Minimum 7 ns (The definition is different from that of actual MCUs. For details, see Figure 5.5.)

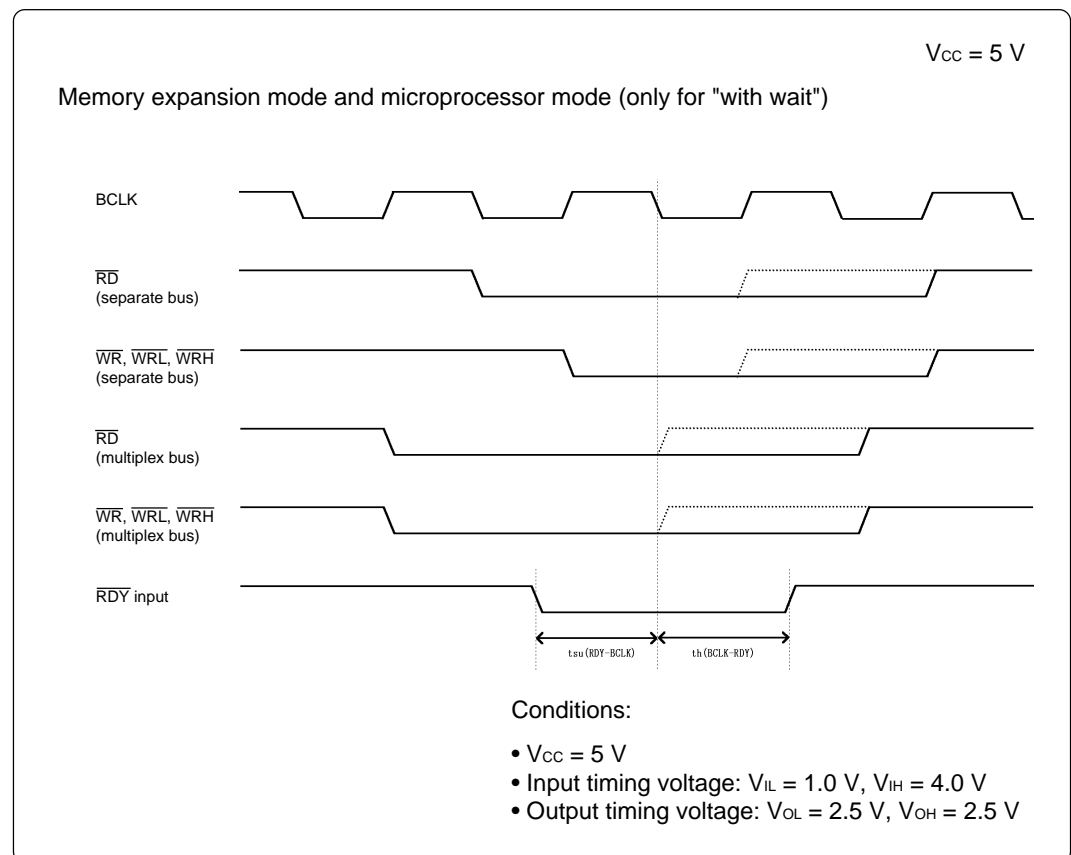
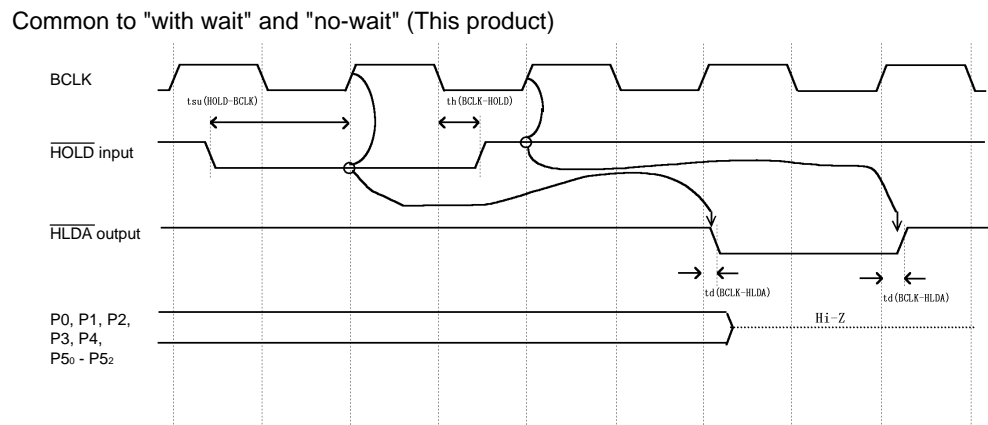
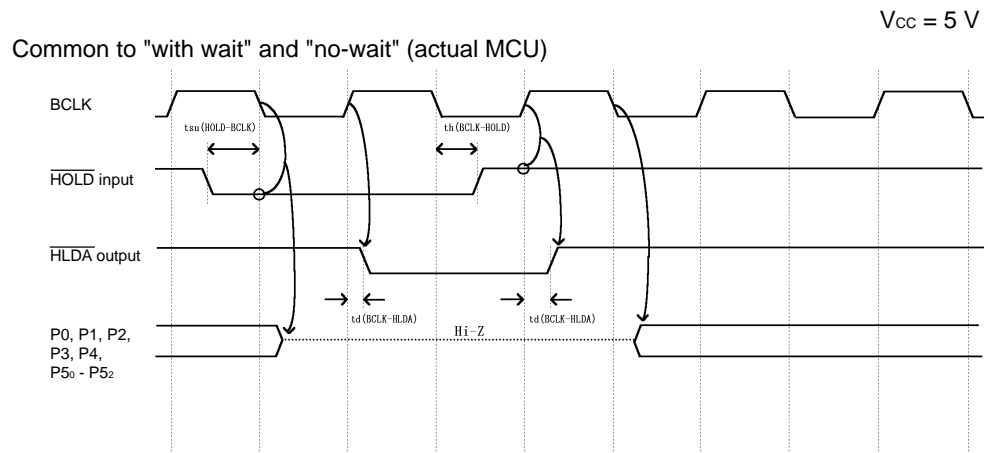


Figure 5.4 Timing requirements



Note 1. P00 through P52 will be high-impedance status regardless of the input level of BYTE pin and ports P40 through P43 function selection bit (PM06) of the processor mode register 0.

Note 2. This product will be high-impedance delaying by 2.5 cycles than an actual MCU.

Note 3. The setup time of HOLD is defined by the startup of BCLK, differently from that of actual MCUs.

Conditions:

- $V_{CC} = 5\text{ V}$
- Input timing voltage: $V_{IL} = 1.0\text{ V}$, $V_{IH} = 4.0\text{ V}$
- Output timing voltage: $V_{OL} = 2.5\text{ V}$, $V_{OH} = 2.5\text{ V}$

Figure 5.5 Timing requirements

5.3 Electrical Characteristics

Tables 5.6 and 5.7 list IC electrical characteristics of the user interface.

*Table 5.6 Electrical characteristics of the 74HC4066AFT
(P100 to P107, AN0 to AN7, AN00 to AN07, AN20 to AN27)*

Symbol	Parameter	V _{CC}	Standard values			Unit
			Min.	Standard	Max.	
V _{IHC}	High level control input voltage	4.5	3.15			V
V _{ILC}	Low level control input voltage	4.5			1.35	V
R _{ON}	ON resistance	4.5		96	200	Ω
R _{ON}	Difference of ON resistances	4.5		10		Ω

Table 5.7 Electrical characteristics of the M60081L-0142FP (P00 to P57)

Symbol	Parameter	Condition	Standard values			Unit
			Min.	Standard	Max.	
V _{IL}	Input voltage	V _{CC} = 4.5 V	0		1.35	V
V _{IH}		V _{CC} = 5.5V	3.85		5.5	
V _{OH}	Output voltage	V _{CC} = 5.0 V I _O < 1 μA			0.05	V
V _{OL}			4.95			V
I _{OL}	Output current	V _{CC} = 4.5 V V _{OL} = 0.4 V	8			mA
I _{OH}		V _{CC} = 4.5 V V _{OH} = 4.1 V			-8	mA
I _{IL}	Input leak current	V _{CC} = 5.5 V V _I = 0 V	-1		+1	μA
I _{IH}		V _{CC} = 5.5 V V _I = 5.5 V	-1		+1	μA
I _{OZL}	OFF state output leak current	V _{CC} = 5.5 V V _O = 0 V	-1		+1	μA
I _{OZH}		V _{CC} = 5.5 V V _O = 5.5 V	-1		+1	μA
C _{IO}	I/O pin capacity	f = 1 MHz V _{CC} = 0 V		7	15	pF

5.4 Connection Diagram

Figure 5.6 shows the connection diagram of the M306N0T2-RPD-E. This connection diagram mainly shows the interface section, and the circuits which are not connected to the target system such as the emulator's control system are omitted.

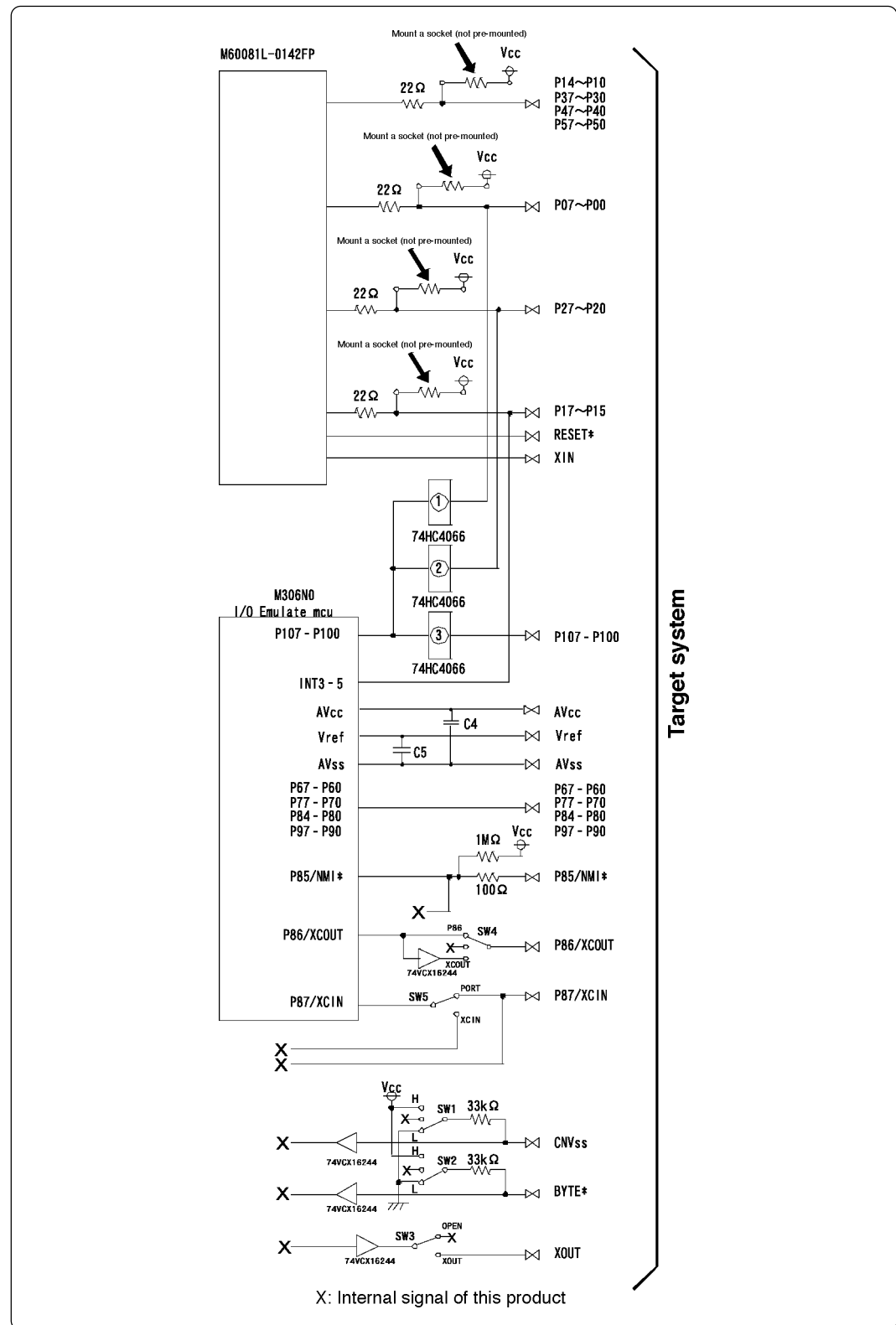


Figure 5.6 Connection diagram

5.5 External Dimensions

(1) External Dimensions of the Emulation Pod

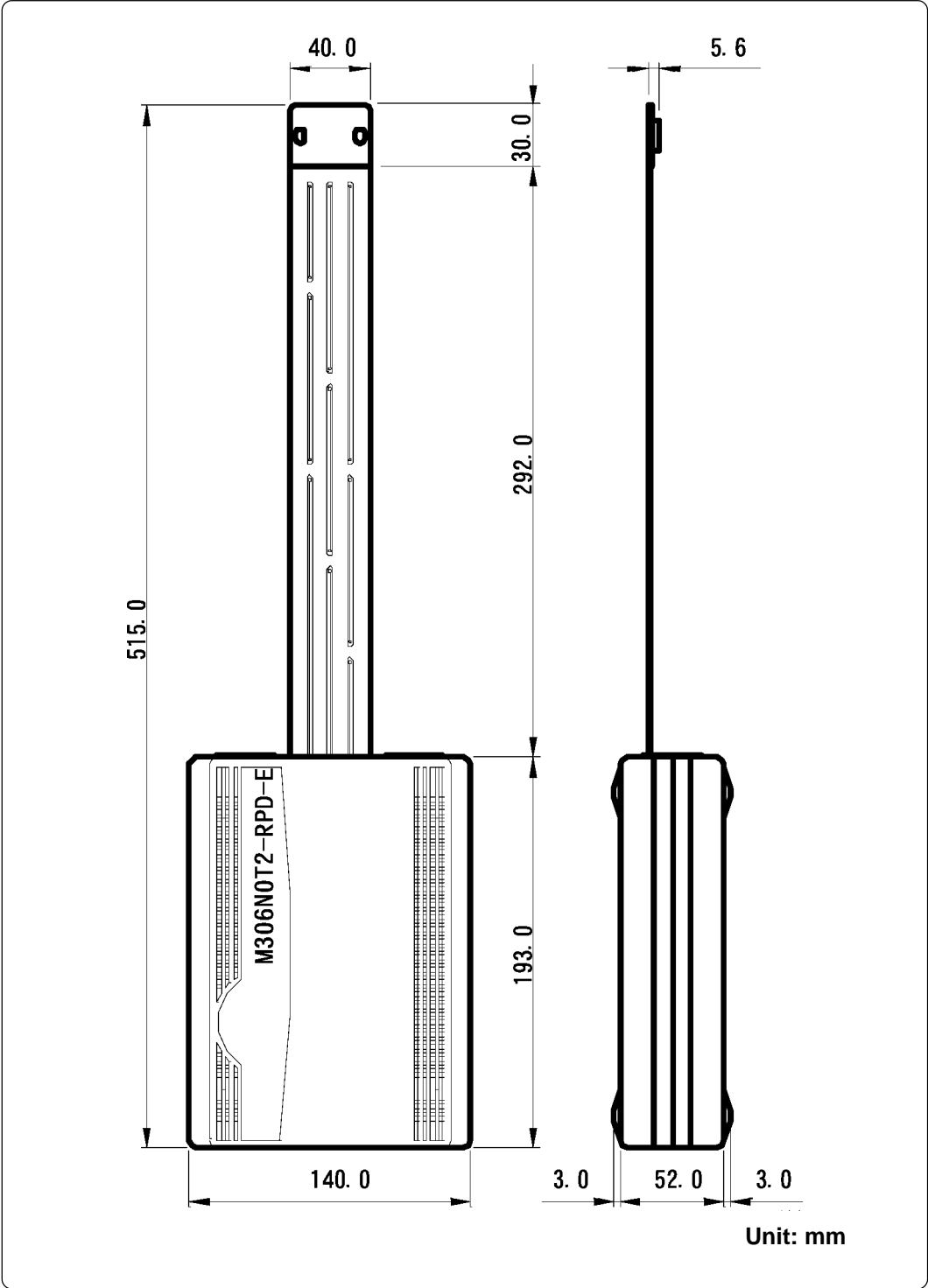


Figure 5.7 External dimensions of the emulation pod

(2) External Dimensions of the Converter Board (FLX-100LCC)

Figure 5.8 shows the external dimensions of the converter board FLX-100LCC for 100-pin LQFP (100D0).

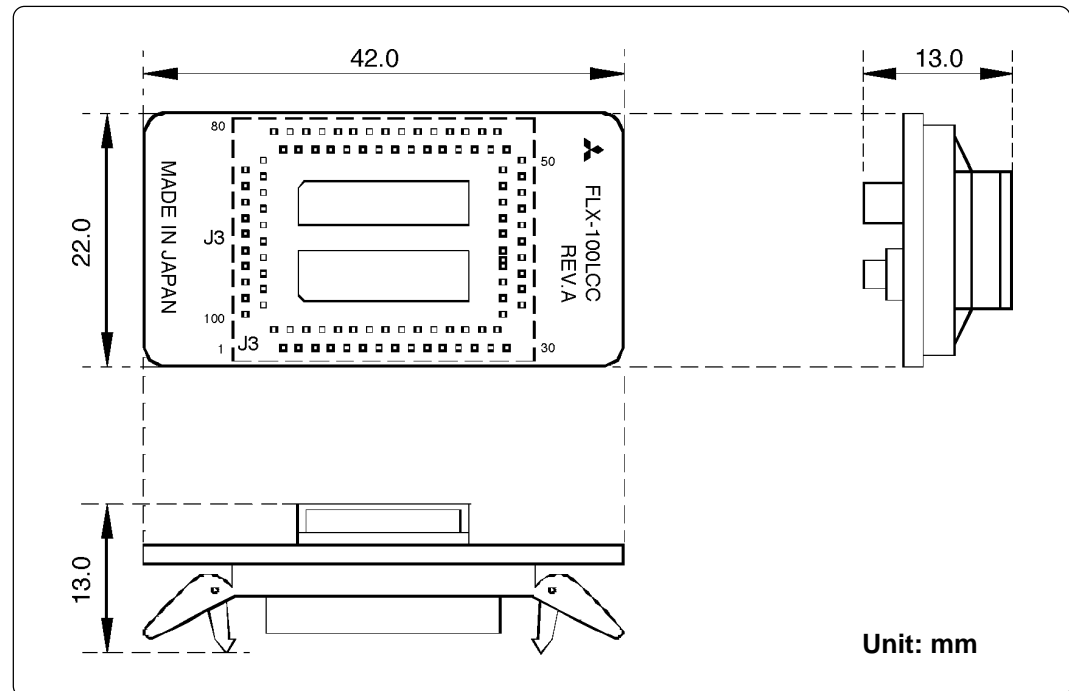


Figure 5.8 External dimensions of the converter board (FLX-100LCC)

(3) Reference Dimensional Drawing for 100-pin 0.65-mm-pitch QFP Foot Patterns

Figure 5.9 shows the sample foot pattern for the Mitsubishi 100P6S-A, the socket IC61-1004-051 (made by Yamaichi Electronics Co., Ltd.) for LCC, the IC socket AXS4003M291 (made by Matsushita Electric Works, Ltd.) for dummy IC and the pitch converter board FLX-100NRB (NQPACK100RB).

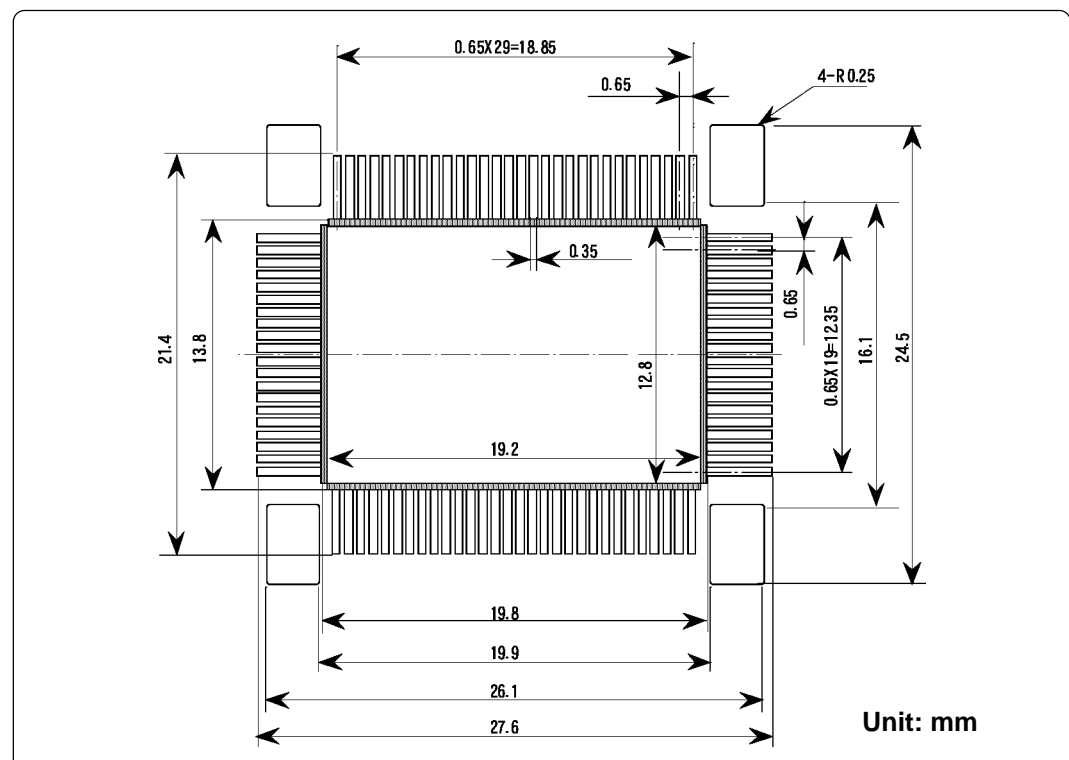


Figure 5.9 Reference dimensional drawing for common 100-pin 0.65-mm-pitch QFP foot pattern

Chapter 6. Troubleshooting

This chapter describes how to troubleshoot when this product does not work properly.

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Chapter 6. Troubleshooting

6.1 Flowchart to Remedy the Troubles

Figure 6.1 shows the flowchart to remedy the troubles from when power to the emulator is activated until the emulator debugger starts up. Check this while the target system is disconnected.

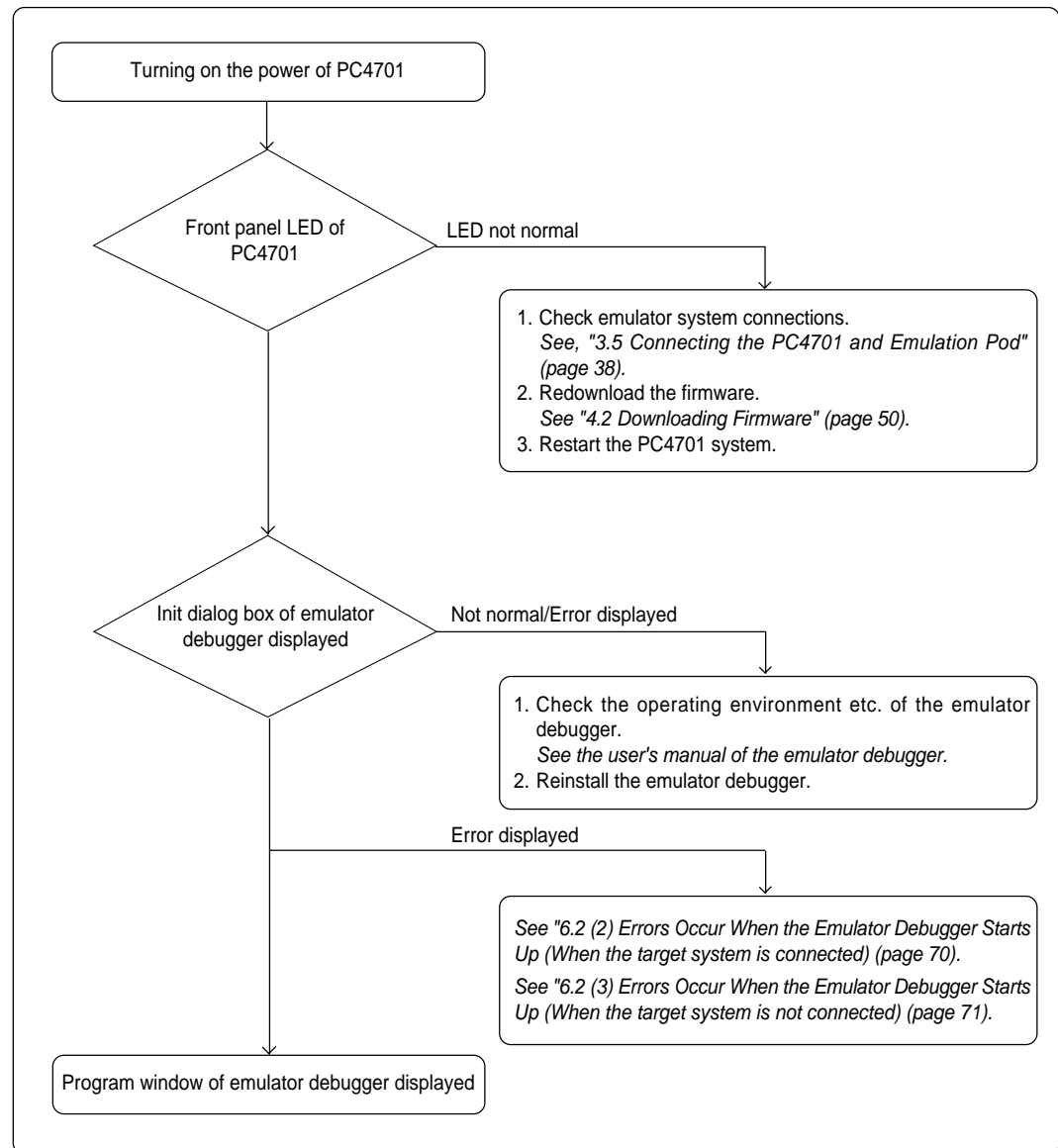


Figure 6.1 Flowchart to remedy the troubles

6.2 When the Emulator Debugger Does Not Start Up Properly

(1) When the LED Display of PC4701 is Abnormal

Table 6.1 LED's abnormal display and its checkpoints

Error	Connection to the target system	Checkpoint
LEDs do not light up.	-	Recheck the power cable is connected to the PC4701. <i>See the instruction manual of the PC4701.</i>
All LEDs remain lit.	-	Recheck the connection between the PC4701 and this product. <i>See "3.5 Connecting the PC4701 and Emulation Pod" (page 38).</i>
The "POWER" LED of "STATUS OF TARGET" does not light up.	Connected	Check power is properly supplied to the target system and that the target system is properly grounded.
The "CLOCK" LED of "STATUS OF TARGET" does not light up.	Disconnected	(1) Check both the main and sub clocks of the emulator debugger are not set to "EXT". <i>See the CLK command of the emulator debugger.</i> (2) Check the oscillation circuit in the emulation pod is oscillating. <i>See "3.3 Selecting Clock Supply" (page 33).</i>
	Connected	(1) Check the oscillation circuit in the target system is oscillating. (2) Check the switches in the emulation pod are correctly set. <i>See "3.2 Setting Switches and Pullup Resistors" (page 29).</i>

(2) Errors Occur When the Emulator Debugger Starts Up (When the target system is connected)

Table 6.2 Checkpoints of errors when starting up the emulator debugger (target is connected)

Error	Checkpoint
Communication error occurred Data was not sent to the target	Check all emulator debugger settings, interface cable connection and switches on the rear of the PC4701 match. <i>See the user's manuals of the PC4701 and the emulator debugger.</i>
Target system cannot be properly built	(1) Download the proper firmware. <i>See "4.2 Downloading Firmware" (page 50).</i> (2) Recheck the connection between the PC4701 and this product. <i>See "3.5 Connecting the PC4701 and Emulation Pod" (page 38).</i>
PD30 version is not the same version as the firmware in the target	Download the proper firmware. <i>See "4.2 Downloading Firmware" (page 50).</i>
Target MCU is in the reset state	Check the reset pin of the target system has changed from "L" to "H" level.
Target MCU cannot be reset	(1) Check the RESET* pin and NMI* pin are "H" level. (2) If in memory expansion mode or microprocessor mode, check the RDY* pin and HOLD* pin are "H" level. (3) If the reset circuit of the target system has a watchdog timer, disable the timer. (4) Check power is properly supplied to the target system and that the target system is properly grounded. (5) The program may be uncontrollable in areas where memory not allocated. Recheck the map setting. <i>See the user's manual of the emulator debugger.</i>
Target is in HOLD state	(1) The MCU is either in the stop mode or wait mode. Either reset the MCU or cancel the mode with an interrupt. <i>See the MCU specifications.</i> (2) The program may be uncontrollable in areas where memory not allocated. Recheck the map setting. <i>See the user's manual of the emulator debugger.</i>
Target clock is stopped	(1) Check the oscillation circuit of the target system is oscillating properly. (2) Check the switches in the emulation pod are correctly set. <i>See "3.2 Setting Switches and Pullup Resistors" (page 29).</i>
Target MCU is not receiving power	Check power is properly supplied to the target system and the target system is properly grounded.

(3) Errors Occur When the Emulator Debugger Starts Up
(When the target system is not connected)

Table 6.3 Checkpoints of errors when starting up the emulator debugger (target is not connected)

Error	Checkpoint
Communication error occurred Data was not sent to the target	Check all emulator debugger settings, interface cable connection and switches on the rear of the PC4701 match. <i>See the user's manuals of the PC4701 and the emulator debugger.</i>
Target system cannot be properly built	(1) Download the proper firmware. <i>See "4.2 Downloading Firmware" (page 50).</i> (2) Recheck the connection between the PC4701 and this product. <i>See "3.5 Connecting the PC4701 and Emulation Pod" (page 38).</i>
PD30 version is not the same version as the firmware in the target	Download the proper firmware. <i>See "4.2 Downloading Firmware" (page 50).</i>
Target MCU cannot be reset	The program may be uncontrollable in areas where memory not allocated. Recheck the map setting. <i>See the user's manual of the emulator debugger.</i>
Target is in HOLD state	(1) The MCU is either in the stop mode or wait mode. Either reset the MCU or cancel the mode with an interrupt. <i>See the MCU specifications.</i> (2) The program may be uncontrollable in areas where memory not allocated. Recheck the map setting. <i>See the user's manual of the emulator debugger.</i>
Target clock is stopped	Check the switches in the emulation pod are correctly set. <i>See "3.2 Setting Switches and Pullup Resistors" (page 29).</i>

6.3 Operation Differs from That of Actual MCUs

(1) Cannot Reset from the Target System

Set the rise time (0.2 Vcc to 0.8 Vcc) 1 μ s or less.

(2) Data Values of ROM Area at Power-on Are Different

For this product, 04h is written into the ROM area at power-on. Therefore, the data values are different from those of an actual MCU.

(3) HOLD* Control

When inputting "L" to the HOLD* pin to run into the HOLD state, P00 to P52 will be in the HOLD state delaying by 2.5 cycles than the actual MCU (see Figure 5.5 and Table 5.5).

(4) A-D Conversion Values are Different from Expected Values

As a flexible cable, a pitch converter board and other devices are used between the evaluation MCU and the target system, some characteristics are slightly different from those of the actual MCU. Therefore, be sure to evaluate your system with an actual MCU.

(5) Outputs of ALE, Address and Others are Different from Those of Actual MCUs

This product has some output signals which are different from those of actual MCU as following.

- ALE signal output in accessing the SFR area
- Address, BHE* and ALE signal outputs in accessing the internal RAM and ROM
- State of the data bus in the stop mode and wait mode

For details, see Chapter 1 "Note on Differences between Actual MCU and Emulator" (page 17).

Chapter 7. Maintenance and Guarantee

This chapter describes how to maintenance, repair provisions and how to request for repair.

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Chapter 7. Maintenance and Guarantee

7.1 Maintenance

If dust or dirt collects on any equipment of your emulation system, wipe it off with a dry soft cloth. Do not use thinner or other solvents because these chemicals can cause the equipment's surface coating to separate.

7.2 Guarantee

The emulation pod presented here has passed Mitsubishi's product inspection. If your emulation pod becomes faulty within 12 months after purchase while being used under good conditions by observing the Precautions for Safety described in "Chapter 1. Precautions for Safety", Mitsubishi will repair the fault free-of-charge. (This provision does not apply to emulation pods leased to you.) When repair is required, contact your nearest of Mitsubishi office or its distributor.

7.3 Repair Provisions

If a fault in your equipment falls under one of the following categories, the fault will be corrected by replacing the entire equipment instead of repairing, depending on the severity of fault:

- Faulty or broken mechanical section
- Flaw, separation, or rust in coated or plated section
- Flaw or crack in plastic section
- Fault or breakage caused by incorrect use or unauthorized repair or modification
- Heavily damaged electric circuits due to shorting of power supply, overvoltage, or overcurrent
- Crack in printed circuit board or burned-down patterns
- Broad range of fault making replacement less expensive than repairing
- Unlocatable or unidentifiable fault

7.4 How to Request for Repair

If your M306N0T2-RPD-E is found faulty, follow the procedure below to send your product for repair.

Customers



Something found faulty

Write down the necessary information in the “M306N0T2-RPD-E Repair Request Sheet” attached hereto, then send it along with the M306N0T2-RPD-E for repair to your distributor or nearest office of Mitsubishi Electric.

Make sure that information in the M306N0T2-RPD-E Repair Request Sheet is written in as much detail as possible to facilitate repair.

Distributors



Contents of fault checked

After checking the contents of fault, the distributor should please send the faulty M306N0T2-RPD-E along with the Repair Request Sheet to Mitsubishi Electric.

Mitsubishi Electric Semiconductor Systems Corporation, Repaired by

When the faulty M306N0T2-RPD-E is repaired, it will be returned to the customer at the earliest convenience.

IMPORTANT

Note on Transporting the Product:

- When sending your M306N0T2-RPD-E for repair, use the packing box and cushion material supplied with the M306N0T2-RPD-E when delivered to you and specify handling caution for it to be handled as precision equipment. If packing of your product is not complete, it may be damaged during transportation. When you pack your product in a bag, make sure to use conductive polyvinyl supplied with the M306N0T2-RPD-E (usually a blue bag). When you use other bags, they may cause a trouble on your product because of static electricity.

M306N0T2-RPD-E Repair Request Sheet

Date:___/___/___(Total Pages:)

To Distributor:

Contact Address	Product Information
Company:	Product name: M306N0T2-RPD-E
Department:	Serial number:
Responsible person:	Date of purchase:
Phone:	Target MCU:
FAX:	Frequency: MHz
E-mail:	Voltage: V
Address:	
Symptoms: Write in detail by itemizing each observed symptom.	
<div style="border: 1px solid black; padding: 5px; float: right; width: 200px;"> Occurrence frequency • Regularly • Frequency() </div>	
Cause of fault: Write your estimated cause of fault or the sequence of operation when the fault occurred.	
Operating environment:	
Emulator: _____ Serial number: _____	
LAN option [<input type="checkbox"/> installed / <input type="checkbox"/> not installed]	
Serial number of PC4701LAN: _____	
Host machine: _____	OS & version: V . .
Emulator debugger: _____	V . .
Remarks: If you have any special request such as your desired delivery period, write it down here.	

Technical Support Communication Sheet

Date:___/___/___(Total Pages:)

To Distributor:

Contact Address	Product Information
Company:	Emulator:
Department:	Serial number:
Responsible person:	Emulation Pod:
Phone:	Serial number:
FAX:	Emulator debugger:
E-mail:	Version:
Address:	License ID: - - - -
	Host machine:
	OS & version:
	Target MCU:
Message:	